

SYSTEMATIC STUDIES OF
AMERICAN PLANTS

ADVERTISEMENT

The United States National Herbarium, which was founded by the Smithsonian Institution, was transferred in the year 1868 to the Department of Agriculture, and continued to be maintained by that department until July 1, 1896, when it was returned to the official custody of the Smithsonian Institution. The Department of Agriculture, however, continued to publish the series of botanical reports entitled "Contributions from the United States National Herbarium," which it had begun in the year 1890, until, on July 1, 1902, the National Museum, in pursuance of an act of Congress, assumed responsibility for the publication. The first seven volumes of the series were issued by the Department of Agriculture.

ALEXANDER WETMORE,
Assistant Secretary, Smithsonian Institution.

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UNITED STATES NATIONAL MUSEUM

CONTRIBUTIONS

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VOLUME 20

SYSTEMATIC STUDIES OF AMERICAN PLANTS

BLAKE, EVANS, PAYSON, PENNELL, PIPER,
PITTIER, STANDLEY, VAN ESELTINE



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N O T E

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P R E F A C E

Volume 20 of the Contributions consists of 14 parts. The first is an account of the Mexican and Central American species of *Ficus*, by Mr. Paul C. Standley, Assistant Curator of the United States National Herbarium. In this study the author has had access to a large series of specimens, being thus enabled to distinguish the characters which are really constant and consequently of specific value. As a result it has been found necessary to reduce to synonymy many of the published names. Since little attention has been devoted to the tropical American figs during the last 50 years, the material obtained by recent collectors has yielded a comparatively large number of new species.

In part 2, Mr. Henry Pittier, of the Bureau of Plant Industry, United States Department of Agriculture, discusses the leguminous genus *Lonchocarpus*, chiefly the species found in middle America. The study is based on an extensive series of specimens collected by the author and on the material contained in several of the larger American herbaria. The genus has been much neglected in recent years and is now found to embrace many more species than have hitherto been recognized. The fuller knowledge gained by a study of these new species and of the older species has led to material changes in the accepted classification. Mr. Pittier finds that the middle American species are in the main distinct from extralimital species in their sectional grouping. For convenience, or for purposes of comparison, a number of South American and West Indian species also are described.

In part 3, Mr. Pittier publishes further results of his studies of middle American plants, chiefly trees. Most of the species described are new. They are distributed among 10 families, the largest number belonging to the Fabaceae. A feature of general interest is the redescription of the cow tree or milk tree, the "palo de vaca" of Humboldt, in the light of new information, with notes on its economic importance.

Part 4 consists of a revision, by Edwin Blake Payson, of the columbines of North America. The work was carried on at the University of Wyoming under the direction of Prof. Aven Nelson and is based upon the material contained in several American herbaria. The author had the advantage also of personal familiarity with many of the species in the field. The singularity and beauty of the columbines have given them well-merited popularity as wild flowers, and several

species are already in successful cultivation. One of the most striking of the Rocky Mountain species, *Aquilegia caerulea*, has been adopted by the State of Colorado as its floral emblem.

Part 5, by Mr. G. P. Van Eseltine, of the Bureau of Plant Industry, United States Department of Agriculture, deals with the southeastern species of *Selaginella* allied to *S. rupestris*. Notwithstanding the attention previously given this group, it is apparent that the species are imperfectly delimited in current treatments and are in need of critical revision. A more satisfactory treatment is now possible through the study of additional material which has accumulated as a result of recent botanical exploration.

Part 6, which is the third of a series upon tropical American phanerogams by Mr. Standley, consists chiefly of descriptions of new species of shrubs and trees, largely Leguminosae from Mexico, and of Rubiaceae from several regions of tropical North America. The former are preliminary to the proposed publication of a systematic work upon the woody plants of Mexico, upon which Mr. Standley is engaged. There is included a synopsis of the Mexican and Central American species of *Erythrina*, a group whose species have long been in confusion.

Part 7 consists of two papers by Dr. S. F. Blake, of the Bureau of Plant Industry, United States Department of Agriculture. The first, entitled The Genus *Homalium* in America, is a revision of a difficult genus of the family Flacourtiaceae, the species of which are valued as timber trees. The number of species recognized is 19, 11 of which are described as new. The second paper, entitled New South American Spermatophytes Collected by H. M. Curran, describes 13 new species, chiefly shrubs or trees, from recent collections in the State of Bahia, Brazil, and the Department of Bolivar, Colombia. These collections were made by Mr. Curran in connection with a general survey of the timber resources of the regions mentioned.

Part 8, by Prof. Alexander W. Evans, of Yale University, deals with the North American representatives of *Asterella*, a difficult group of liverworts concerning whose classification there has been no general agreement. The present study fixes the type of the genus, discusses the general morphology of the group, describes the North American species, three of which are new, and contains a key for their identification.

Part 9, by Dr. Francis W. Pennell, consists of an account of several genera of the family Scrophulariaceae as represented in the central Rocky Mountain States. The greater part of the paper relates to the genus *Pentstemon*, a large and difficult group containing many species which are among the most characteristic and attractive members of the Rocky Mountain flora. Because of the intensive character of the study, which is based largely on field work by the author, it has

been possible to indicate with unusual precision the range, habitat, and period of flowering of most of the species, and for the same reason it has been found necessary to describe a considerable number of them as new.

Part 10 consists of four papers by Dr. S. F. Blake, comprising revisions of the genera *Acanthospermum*, *Flourensia*, *Oyedaea*, and *Tithonia*. All these are members of the family Asteraceae, and are confined in their distribution to the tropical and subtropical portions of North and South America. The study of these groups has been based upon the material in the United States National Herbarium and the Gray Herbarium, and upon that of several important European herbaria.

Part 11, by Prof. Charles V. Piper, is entitled The Identification of *Berberis aquifolium* and *Berberis repens*. The introduced European barberry, *B. vulgaris*, has long been known as the host of one stage of the destructive stem rust of wheat, and the United States Department of Agriculture is now engaged in a campaign to eradicate this species in the north-central wheat-producing States in order to control destructive epidemics of this rust. A study of other native and introduced species of barberry is now in progress to determine whether they, also, may serve as hosts of the stem rust or of related rusts of cereals and other grasses, or whether they are immune to this fungus. The need of an accurate understanding of the species of *Berberis* is of obvious importance. In this paper Professor Piper has settled a doubt of long standing regarding the identity of two north-western species belonging to the section *Odostemon*, or *Mahonia*.

Part 12, by Mr. Pittier, consists mainly of revisions of critical groups of Middle American trees, the more important dealing with *Machaerium*, *Pithecollobium*, and *Lucuma*, of the families Fabaceae, Mimosaceae, and Sapotaceae. There are included also a key to the Mexican and Middle American species of *Vitex*, with descriptions of several new species, and a revision of the cucurbitaceous genus *Calycophysum*. Descriptions of three new species of *Zanthoxylum* from Panama are contributed by Mr. Percy Wilson, of the New York Botanical Garden.

Part 13 consists of three papers by Dr. S. F. Blake. In the first, entitled Revision of the American Species of *Rinorea*, 39 species are recognized. *Rinorea* is a genus of the family Violaceae, consisting of trees or shrubs with inconspicuous flowers, and is well represented in the American tropics. The second paper, entitled New Plants from Venezuela, contains descriptions of 34 new species of flowering plants and of a single new moss, the latter contributed by Mr. R. S. Williams. The third paper describes *Hemibaccharis*, a new genus of Baccharidinae, consisting of 15 species, 6 of which are new. This

new genus is somewhat intermediate in character between *Baccharis* and *Conyza* (*Eschenbachia*) and its recognition materially clarifies the generic relationships in its group.

The final paper of the volume (part 14), entitled *The American Species of Canavalia and Wenderothia*, was suggested by the confusion discovered by Professor Piper in this group of plants while he was studying their economic possibilities. A paper dealing with the Old World species, by C. V. Piper and S. T. Dunn, was published in the *Bulletin of the Royal Botanic Gardens, Kew*, in 1922. In studying the American species Professor Piper has had access to all the material in American herbaria, besides that at Kew, including nearly all the types. The genus *Wenderothia* of Schlechtendal has been restored, 12 species being recognized, one of which is new. In *Canavalia* there are 26 species in 4 sections, 13 being new. The economic importance of the group is not great. *Canavalia gladiata* is widely but rather sparingly cultivated in the tropics and subtropics, the seeds being used as food. *C. ensiformis* is employed as a green manure crop, and the seeds, occasionally eaten, are now the commercial source of urease. *C. campylocarpa* is used in the West Indies as a green manure crop.

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THE MEXICAN AND CENTRAL AMERICAN SPECIES OF FICUS.

By PAUL C. STANDLEY.

INTRODUCTION.

The best-known representatives of the genus *Ficus* are the common cultivated fig, *Ficus carica*, and the rubber plant, *F. elastica*. The genus is a very large one, including, according to Engler,¹ about 600 species. The actual number is considerably greater, however, for many species have been described in the last 25 years, especially from Africa and the Philippine Islands. The species are distributed throughout the Tropics, but they are most abundant in the East Indies and Africa. Thirty-three are reported from the West Indies by Warburg in his recent revision of the West Indian representatives of the genus, and about 50 are known to occur in South America. In the present paper 41 species are enumerated for Mexico and Central America. It is a remarkable fact that only two of these are common to the West Indies and Central America, and one of them is doubtfully indigenous to the latter region.

The first species to be described from the area here treated was *Ficus calyculata*, published by Philip Miller in 1768.² Unfortunately the description is so brief that Miller's plant can not be identified with certainty. Kunth,³ in 1817, described five new species from Mexico. In 1851 Liebmann published⁴ the first extensive enumeration of the Mexican and Central American species, basing his report chiefly upon his own collections and those of Örsted. His list included 29 names, most of which were new. In 1862 Miquel also published⁵ a list for the same region, which included 40 names, several of them representing new species. Other authors have described isolated species, but most of those heretofore published from the area under discussion were founded by Liebmann

¹ In Engl. & Prantl, *Pflanzenfam.* 3¹: 89. 1889.

² Gard. Dict. ed. 8. *Ficus* no. 11.

³ In H. B. K. *Nov. Gen. & Sp.* 2: 46-49.

⁴ *Dansk. Vid. Selsk. Skrivt.* V. 2: 319-333.

⁵ *Versl. Med. Kon. Akad. Amsterdam* 13: 407-414.

and Miquel. Hemsley, in 1883, listed ¹ 44 species of *Ficus* from Mexico and Central America, a number slightly in excess of that recognized by the present writer.

The nomenclature of the Central American species has been found to be in a chaotic state, and the material in American herbaria, as a consequence, for the most part incorrectly named. Scarcely any attempts, apparently, have been made to identify the species of Kunth, Liebmann, and Miquel, and some of the most distinct species have been redescribed, in spite of the fact that the early descriptions were usually ample and carefully drawn.

Chiefly as a result of a better understanding of the characters, obtained from the great amount of material now available for comparison, the writer has found it necessary to reduce to synonymy many of the early names, and in some cases to unite under a single name two or more published by an author at one time.

While many of our species are constant in their characters, some are so variable that two collections may seem to represent quite distinct species until intermediate specimens are examined. Some characters which have been used to separate species are now found to be unreliable. Consequently, it is not improbable that certain species here recognized will have to be reduced when still more ample collections are obtained.

Ficus is usually subdivided into five to eight sections or subgenera. In the Western Hemisphere only two are represented, *Pharmacosyce* and *Urostigma*, the former exclusively American. Attempts have been made to divide the genus into several genera, and for a time *Urostigma* and *Pharmacosycea* were recognized as distinct genera. Some authors have united the two American subgenera under the subgenus *Urostigma*, but while the differences between the two are not very great, in the case of the Central American species they happen to be easily determinable. All recent authors have deemed it best to preserve *Ficus* in its broad sense.

In making the present revision the writer has examined, besides the collections in the National Herbarium, those in the Gray Herbarium, the herbarium of the Field Museum of Natural History, and the herbarium of the University of California. To the curators of those collections he is greatly indebted for the opportunity of studying the additional material.

¹ Biol. Centr. Amer. Bot. 3: 143-148.

SYSTEMATIC TREATMENT.

KEY TO THE SPECIES.

- Receptacles solitary; involucre trilobate; stamens 2. (Subgenus PHARMACOSYCE.)
- Leaf blades hirtellous or short-pilose beneath; receptacles pilose or hirtellous. 1. *F. glaucescens*.
- Leaf blades glabrous or merely scabrous beneath; receptacles glabrous or nearly so, at least in age, or sometimes scabrous.
- Young branches densely pilose-sericeous. Leaf blades glabrous, gradually acute or acuminate at the apex. 2. *F. radulina*.
- Young branches glabrous or finely and sparsely puberulent.
- Lateral veins of the leaf blades very coarse and stout, 1.5 to 4.5 cm. apart, about 10 on each side; leaf blades very large, 12 to 24 cm. long, 6 to 12.5 cm. wide, glabrous, rounded and abruptly apiculate at the apex. 3. *F. tonduzii*.
- Lateral veins slender, usually not more than 1 cm. apart; leaf blades mostly much smaller.
- Leaf blades gradually acute to long-acuminate at the apex.
- Blades of the leaves about 4 times as long as broad, acute at the base, glabrous. 4. *F. segoviae*.
- Blades of the leaves not more than two and one-half times as long as broad, usually very obtuse or rounded at the base.
- Lateral veins of the leaf blades 14 to 21 on each side, the surfaces glabrous. 5. *F. glabrata*.
- Lateral veins usually 12 to 15 on each side, the surfaces usually very scabrous. 6. *F. mexicana*.
- Leaf blades rounded or very obtuse at the apex or abruptly apiculate.
- Stipules 1 to 1.5 cm. long; leaf blades scabrous, usually apiculate, the lateral veins 7 to 12 on each side. 7. *F. radula*.
- Stipules 4 to 6 cm. long; leaf blades glabrous, very obtuse at the apex, not apiculate, the lateral veins 14 to 22 on each side. 8. *F. crassiuscula*.
- Receptacles geminate; involucre bilobate¹; stamen 1. (Subgenus UROSTIGMA.)
- Involucre very asymmetric, adherent to the receptacle over a large portion of its surface, the receptacle attached eccentrically to the peduncle and its main axis thus parallel to that of the supporting branch. Receptacles 5 to 10 mm. in diameter; leaf blades glabrous.
- Receptacles pedunculate. 9. *F. tecolutensis*.

¹ Very often the involucre appears to have more than 2 lobes, but this is because the lobes are split by the expanding receptacle.

Receptacles sessile.

Leaf blades pointed at the apex, obtuse to acute or apiculate, oval to obovate, never obovate-oval or obovate-orbicular.

Blades of the leaves 5 to 10.5 cm. long, 2 to 4 cm. wide, the lateral veins scarcely prominent beneath, 8 to 12 on each side..... 10. *F. eugeniaefolia*.

Blades of the leaves 8.5 to 17 cm. long, 4 to 9.5 cm. wide, the lateral veins prominent beneath, 7 to 9 on each side..... 11. *F. tuerckheimii*.

Leaf blades broadly rounded at the apex, usually rounded-oval or obovate-orbicular.

Blades of the leaves deeply emarginate at the base, the lateral veins prominent beneath..... 12. *F. isophlebia*.

Blades of the leaves not at all emarginate at the base, the lateral veins not elevated..... 13. *F. jimenezii*.

Involucre symmetric, free from the receptacle or nearly so, the receptacle attached centrally to the peduncle or branch, its main axis thus forming an angle with that of the supporting branch.

Receptacles sessile or, in one species, some sessile and others pedunculate.

Leaf blades very large, 20 to 36 cm. long, pubescent beneath..... 14. *F. intramarginalis*.

Leaf blades smaller, not over 16.5 cm. long and usually much smaller.

Receptacles partly sessile and partly pedunculate on the same plant. Leaf blades nearly as broad as long, glabrous or nearly so..... 15. *F. cookii*.

Receptacles all sessile.

Leaf blades cuspidate at the apex, with a long acute acumen. Blades narrowly obovate-oblong, 9 to 16.5 cm. long, glabrous..... 16. *F. panamensis*.

Leaf blades not cuspidate at the apex, sometimes apiculate or abruptly acuminate, but the acumen obtuse.

Receptacles 12 to 14 mm. in diameter or larger. Leaf blades oblong or elliptic-oblong, 10 to 14 cm. long..... 17. *F. williamsii*.

Receptacles 5 to 12 mm. in diameter.

Leaf blades deeply cordate at the base, pubescent on both surfaces, broadly rounded at the apex..... 18. *F. inamoena*.

Leaf blades subcordate to rounded at the base, glabrous on the upper surface or nearly so.

Receptacles 5 to 6.5 mm. in diameter; leaf blades abruptly acute or acuminate at the apex, with only 2 to 4 lateral veins on each side..... 19. *F. colubrinae*.

Receptacles 6 to 12 mm. in diameter; leaf blades broadly rounded to obtuse at the apex, sometimes short-apiculate, with usually 5 to 7 veins on each side.

Stipules more or less persistent, 0.8 to 2.5 cm. long; leaf blades mostly obovate-oblong or obovate, glabrous. Receptacles glabrous..... 20. *F. costaricana*.

Stipules early deciduous; leaf blades not obovate-oblong, sometimes orbicular-obovate, usually conspicuously pubescent beneath.

Involucre small, about 5 mm. in greatest diameter, inconspicuous; receptacles glabrous..... 21. *F. kellermanii*.

Involucre large, conspicuous, inclosing the receptacle for half to two-thirds its length; receptacles finely pubescent or in age glabrate..... 22. *F. cotinifolia*.

Receptacles pedunculate.

Leaf blades conspicuously pubescent beneath.

Blades of the leaves suborbicular, as broad as long, deeply cordate at the base, with tufts of long white hairs along the costa beneath, otherwise glabrous.. 23. *F. petiolaris*.

Blades of the leaves usually conspicuously longer than broad, the pubescence of short hairs scattered over the lower surface.

Receptacles 8 to 9 mm. in diameter, minutely puberulent or glabrate; leaf blades 3 to 5 times as long as broad..... 24. *F. donnell-smithii*.

Receptacles 10 to 22 mm. in diameter, usually conspicuously pubescent; leaf blades less than two and one-half times as long as broad.

Stipules glabrous or nearly so; receptacles pyriform.

Leaf blades cordate-ovate or ovate-deltoid.... 25. *F. palmeri*.

Stipules densely pilose-sericeous; receptacles globose.

Receptacles 10 to 13 mm. in diameter; leaf blades 4.5 to 12 cm. long, usually broadest at or near the base.

Involucres 10 to 15 mm. in greatest diameter; receptacles covered with fine appressed pubescence or glabrate; peduncles 2 to 4 mm. long..... 27. *F. pringlei*.

Involucres 4 to 6 mm. in greatest diameter; receptacles short-villous; peduncles 5 to 7 mm. long..... 28. *F. microchlamys*.

Receptacles 13 to 22 mm. in diameter; leaf blades 6 to 26 cm. long, broadest at or near the middle.

Pubescence fulvous or ferruginous; peduncles 2 to 3 mm. long; receptacles 15 to 22 mm. in diameter..... 29. *F. velutina*.

Pubescence grayish; peduncles 4 to 9 mm. long; receptacles 13 to 17 mm. in diameter. 30. *F. lapathifolia*.

Leaf blades glabrous beneath or nearly so.

Receptacles 4 to 12 mm. in diameter.

Leaf blades rounded or very obtuse at the apex, 4 to 5.5 cm. wide, emarginate at the base. Receptacles 6 to 8 mm. in diameter..... 31. *F. ovalis*.

Leaf blades acute or acuminate at the apex or conspicuously apiculate, or, if obtuse, less than 3 cm. wide and not emarginate at the base.

Receptacles with a deeply depressed ostiole, 9 to 12 mm. in diameter; leaf blades lanceolate to ovate or lance-oblong, 4 to 12 cm. long, 1.5 to 4.7 cm. wide..... 32. *F. padifolia*.

Receptacles with a plane or elevated ostiole; leaf blades obovate, oval, or elliptic-oval.

Leaf blades mostly obovate; receptacles 5 to 6 mm. in diameter; lateral veins of the leaf blades not prominent..... 33. *F. oerstediana*.

Leaf blades not obovate; receptacles 8 to 10 mm. in diameter; lateral veins of the leaf blades prominent.

Blades of the leaves more than twice as long as broad, mostly elliptic-oblong, emarginate or subcordate at the base..... 34. *F. hemsleyana*.

Blades of the leaves less than twice as long as broad, oval, rounded at the base..... 35. *F. lentiginosa*.

Receptacles 15 to 25 mm. in diameter.

Stipules ferruginous-sericeous. Leaf blades narrowly elliptic-oblong to obovate..... 36. *F. glycarpa*.

Stipules glabrous or minutely puberulent.

Leaf blades cuneate-obovate, rounded at the apex. 37. *F. bonplandiana*.

Leaf blades oblong to oval or ovate-oval, broadest at or below the middle.

Blades of the leaves cordate or subcordate at the base, with 5 to 9 lateral veins on each side.

Petioles 3.5 to 7 cm. long; leaf blades bright green; receptacles pubescent..... 38. *F. jonesii*.

Petioles 1.5 to 3.5 cm. long; leaf blades glaucescent beneath; receptacles glabrous..... 26. *F. brandegei*.

Blades of the leaves rounded or emarginate at the base, with usually 8 to 13 lateral veins on each side.

Peduncles about 3 mm. long. Leaf blades oval, 16 to 21 cm. long, 7.5 to 10.5 cm. wide. 39. *F. pittieri*.

Peduncles 10 to 13 mm. long.

Leaf blades emarginate at the base; receptacles densely puberulent..... 40. *F. goldmanii*.

Leaf blades rounded at the base; receptacles glabrous or nearly so..... 41. *F. yucatanensis*.

DESCRIPTIONS OF SPECIES.

1. *Ficus glaucescens* (Liebm.) Miquel, Ann. Mus. Bot. Lugd. Bat. **3**: 300. 1867.
Pharmacosycea glaucescens Liebm. Dansk. Vid. Selsk. Skrivt. V. **2**: 332. 1851.
Pharmacosycea hernandezii Liebm. Dansk. Vid. Selsk. Skrivt. V. **2**: 332. 1851.
Pharmacosycea rigida Seem. Bot. Voy. Herald 195. 1854, not *Ficus rigida* Jack, 1822.
Urostigma protensum Griseb. Bonplandia **1858**: 4. 1858.
Pharmacosycea pseudoradula Miquel, Versl. Med. Kon. Akad. Amsterdam **13**: 414. 1862.
Ficus pseudoradula Miquel, Ann. Mus. Bot. Lugd. Bat. **3**: 299. 1867.
Ficus hernandezii Miquel, Ann. Mus. Bot. Lugd. Bat. **3**: 300. 1867.
Ficus coybana Miquel, Ann. Mus. Bot. Lugd. Bat. **3**: 300. 1867.
Ficus protensa Hemsl. Biol. Centr. Amer. Bot. **3**: 147. 1883.
Ficus guadalajarana S. Wats. Proc. Amer. Acad. **26**: 151. 1891.

Large or small tree; young branches brown, at first pilose or puberulent but the epidermis soon exfoliating, leaving them glabrous; stipules lance-triangular, 1 to 2 cm. long, long-attenuate, puberulent near the base or glabrate; petioles stout, 8 to 23 mm. long, densely pilose or puberulent at first but soon glabrous and ferruginous, subterete, shallowly canaliculate; leaf blades oval-oblong or obovate-oval, 8 to 23.5 cm. long, 4 to 11.5 cm. wide, obtuse or rounded at the base, sometimes subemarginate, 3 or 5-nerved, rounded or very obtuse at the apex or usually abruptly and obtusely apiculate, scaberulous or glabrate on the upper surface, beneath hirtellous or short-pilose, the lateral veins prominent beneath, 7 to 12 on each side, divaricate-ascending, nearly straight or arcuate, irregularly anastomosing near the margin, the veinlets loosely reticulate, not very conspicuous; peduncles solitary, 0.5 to 2 cm. long, stout, densely short-pilose; involucre very small, trilobate, the lobes rounded; receptacles subglobose, 1.5 to 2.5 cm. in diameter, densely short-pilose or hirtellous with white hairs.

TYPE LOCALITY: Mecapalco and Potrero de Consoquintla, Veracruz. Type collected by Liebmann.

SPECIMENS EXAMINED:

JALISCO: Barranca near Guadalajara, October, 1889, *Pringle* 2947 (G,¹ type of *F. guadalajarana*).

SINALOA: Foothills of the Sierra Madre near Plomosas, July, 1897, *Rose* 1767 (N).

OAXACA: Vicinity of Cuicatlán, alt. 540 to 750 meters, October, 1894, *Nelson* 1684 (N, G).

MICHOACÁN: Hacienda Coahuayula, February, 1901, *Emrick* 44 (F).

VERACRUZ: Valley of Córdoba, April, 1866, *Bourgeau* 2249 (G).

GUATEMALA: Río Ocosito, Department of Quezaltenango, alt. 100 meters, April, 1892, *J. D. Smith* 2602 (N, G).

NICARAGUA: Chinandega, on stream banks, January, 1903, *C. F. Baker* 583 (N).

PANAMA: Around Culebra, Canal Zone, alt. 50 to 150 meters, January, 1911, *Pittier* 2211 (N). Hospital grounds at Ancón, February, 1911, *Pittier* 2728 (N).

All the specimens cited above agree in having pubescent leaf blades and receptacles. They show a rather wide variation in leaf outline, but not more than may be expected within a species.

The type of *Pharmacosycea hernandezii* was collected at Papantla, Veracruz, by Liebmann. That of *P. rigida*, a homonym later replaced by *Ficus coybana*, was obtained by Seemann on the island of Coyba, off the Pacific coast of Panama. *Urostigma protensum* was based upon material collected in Panama by Duchassaing. The type of *Ficus guadalajarana* was from Guadalajara, Jalisco.

¹ The letters in parentheses indicate the herbaria in which the specimens cited are found, as follows: N, United States National; G, Gray; F, Field Museum of Natural History; O, University of California.

2. *Ficus radulina* S. Wats. Proc. Amer. Acad. 26: 151. 1891.

Large tree; branches yellowish, the younger ones very stout, densely pilose-sericeous with slender white hairs, the pubescence persistent, the epidermis tardily exfoliating; stipules nearly linear, 6 to 8 cm. long, attenuate, green, sericeous near the base, glabrous above; petioles stout or rather slender, 2 to 4.5 cm. long, sparsely hirtello-puberulent; leaf blades oblong, elliptic-oblong, or oval-elliptic, usually broadest at the middle but sometimes broadest slightly below the middle, 9 to 18 cm. long, 3.5 to 8 cm. wide, obtuse or rounded and 5-nerved at the base, not at all emarginate, gradually acute at the apex, pale green, coriaceous, scaberulous on both surfaces or finally glabrate; peduncles solitary, stout, 3 to 5 mm. long, at first puberulent but soon glabrate; involucre very small, trilobate, the lobes rounded; receptacles globose, 1.5 to 2 cm. in diameter, spotted with light and deep green, at first densely scabrous or scabro-puberulent, finally glabrate; ostiole prominent, conic, closed by several thin brown obtuse scales.

TYPE LOCALITY: Hacienda San Miguel, near Batopilas, southwestern Chihuahua. Type collected by Palmer in 1885 (no. L).

SPECIMENS EXAMINED:

CHIHUAHUA: Huerachic, April, 1893, *Hartman* 537 (N, G). Hacienda San Miguel, 1885, *Palmer* L (N, G, type).

SONORA: Alamos, around a dwelling in the town, March, 1910, *Rose, Standley & Russell* 12937 (N); December, 1898, *Goldman* 283 (N, G); March or April, 1890, *Palmer* 367 (N, G). Canyon in Sierra de Alamos, March, 1910, *Rose, Standley & Russell* 12992 (N).

The native names are given as "nacapulí," "higuera," and "salate." The fruit is edible.

The species is very well marked by the densely pubescent young branches.

3. *Ficus tonduzii* Standley, sp. nov.

A large tree; young branches very stout, gray or brownish gray, glabrous; stipules narrowly triangular, long-attenuate, 2 to 2.5 cm. long, deciduous, green, thick, glabrous; petioles very stout, 2 to 5 cm. long, subterete, sulcate, glabrous; leaf blades oval or obovate-oval, 12 to 24 cm. long, 6 to 12.5 cm. wide, rounded to broadly cuneate at the base, rounded or very obtuse at the apex and abruptly apiculate, the acumen broadly triangular and rounded at the apex, thick-coriaceous, glabrous on the upper surface, sublustrous, finely punctate, beneath scaberulous or in age glabrate, very prominently veined, the veins whitish beneath, the costa 2.5 to 4 mm. thick, the lateral veins very stout, about 10 on each side, divergent almost at right angles, nearly straight, anastomosing to form a coarse submarginal vein, the veinlets rather prominent, coarsely reticulate; receptacles subglobose, 2 to 2.5 cm. in diameter, scaberulous; ostiole closed by several suberect obtuse thin brown scales; bractlets very small, rounded; stamens 2.

Type in the U. S. National Herbarium, no. 678727, collected at La Gloria de Juan Viñas, Costa Rica, altitude 800 to 900 meters, June 4 or 5, 1911, by H. Pittier (no. 3665).

ADDITIONAL SPECIMENS EXAMINED:

COSTA RICA: Bois du Tremedal, près San Ramón, alt. 1,300 to 1,400 meters, April, 1913, *Tonduz* 17658 (N, F). Pâturages de Las Vueltas, alt. 635 meters, December, 1898, *Tonduz* 12869 (N). Guápiles, Llanuras de Santa Clara, alt. 200 meters, April, 1894, *J. D. Smith* 4935 (N, G).

COLOMBIA: Santa Marta, alt. 1,200 meters, *H. H. Smith* 1453 (N, G, F).

The species is a very distinct one, easily recognized among our other members of the subgenus *Pharmacosyce* by the very large, coriaceous leaves with coarse, heavy venation. All of the several receptacles of the Costa Rican specimens cited above are detached from the stems; consequently it is impossible to be certain whether they are sessile or pedunculate, but they are probably pedunculate.

In Captain Smith's no. 4935 the tips of the leaf blades are acute instead of rounded. In the Colombian specimens the blades are merely very obtuse and not at all apiculate. In the latter the receptacles have adherent to them a peduncle 12 mm. long. Both these collections, which are referred only tentatively to *F. tonduzii*, were distributed as *Ficus guianensis*, but, judging from descriptions, the latter species is far removed from the present plant.

The common name of the Costa Rican plant is given as "chilamate."

4. *Ficus segoviae* Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 300. 1867.

Pharmacosycea angustifolia Liebm. Dansk. Vid. Selsk. Skrivt. V. 3: 333. 1851, not *Ficus angustifolia* Roxb. 1814.

Young branches brown, glabrous or obscurely puberulent; stipules very narrow, tapering gradually from the base to the long-attenuate apex, 2 to 5.5 cm. long, green, glabrous; petioles slender, 1.5 to 3.5 cm. long, glabrous, canaliculate; leaf blades elliptic, narrowly elliptic, or narrowly oblong-elliptic, 10 to 20 cm. long, 2.5 to 5.5 cm. wide, acutely cuneate at the base and 3-nerved, not at all emarginate, gradually acuminate or long-acuminate at the apex, subcoriaceous, pale green, sparsely scaberulous when young but soon glabrate, the lateral veins prominent beneath, slender, 14 to 20 on each side, divergent at an angle of 55 to 60 degrees, arcuate, laxly anastomosing near the margin, the veinlets not prominent; peduncles solitary, 4 to 5 mm. long, very stout, glabrate; involucre very small, reflexed; receptacles globose, 1.6 to 3 cm. in diameter, at first sparsely scaberulous but soon glabrate; ostiole prominent, the scales broad, rounded, brown; sepals dark ferruginous.

TYPE LOCALITY: Segovia, Nicaragua. Type collected by Ørsted.

SPECIMENS EXAMINED:

GUERRERO: Cañón de la Mano Negra, near Iguala, August, 1905, *Rose, Painter & Rose* 9381 (N).

VERACRUZ: Zacuapan, March, 1909, *Purpus* 3784 (G, F, C).

GUATEMALA: Capetillo, Department of Zacatepéquez, alt. 1,400 meters, March, 1892, *J. D. Smith* 2604 (N, G).

The specimens cited and described agree perfectly with the original description, except for Liebmann's statement that the leaf blades are obtuse at the base. The species is doubtfully distinct from *Ficus glabrata*, but the leaf blades seem to be of characteristic outline.

5. *Ficus glabrata* H. B. K. Nov. Gen. & Sp. 2: 47. 1817.

?*Ficus anthelmintica* Mart. Syst. Mat. Med. Bras. 88. 1843, not *F. anthelmintica* Raeuschel, 1797.

A large tree, often 30 to 40 meters high; young branches stout, brown or pale yellowish brown, glabrous; stipules 5 to 6 mm. long, narrow, tapering gradually from the base to the long-attenuate apex, green, glabrous; leaf blades elliptic-oblong or elliptic-oval, broadest at the middle, 12 to 23 cm. long, 5 to 10 cm. wide, acute to very obtuse at the base and 5-nerved, not at all emarginate, rather abruptly narrowed to the acute or acuminate apex, subcoriaceous or sometimes almost herbaceous, pale green, glabrous, the lateral veins prominent beneath, divergent at an angle of 60 degrees or more, 14 to 21 on each side, approximate, parallel, slightly arcuate, laxly anastomosing near the margin, the veinlets nearly obsolete; peduncles solitary, 7 to 15 mm. long, stout, glabrous; involucre very small, irregularly lobed, the lobes obtuse; receptacles subglobose, 1.5 to 4 cm. in diameter, glabrous or very sparsely and obscurely scaberulous; ostiole prominent, about 1 mm. broad; sepals dark ferruginous.

TYPE LOCALITY: Near Bojorque and Teneriffe, along the Magdalena River, Colombia. Type collected by Bonpland.

SPECIMENS EXAMINED:

GUATEMALA: Gualán, Department of Zacapa, alt. 122 meters, December, 1905, *Kellerman* 5009 (N). Berberena, Department of Santa Rosa, alt. 1,000 meters, November, 1893, *Heyde & Lux* (J. D. Smith, no. 6235) (N, F, G). Casillas, Department of Santa Rosa, alt. 1,300 meters, May, 1893, *Heyde & Lux* (J. D. Smith, no. 4587) (N, G). Laguna Amatitlán, Department of Amatitlán, alt. 1,170 meters, March, 1890, *J. D. Smith* 1945 (N, G). Cubilquitz, March, 1913, *von Türckheim* 4081 (N).

HONDURAS: Shore of Tela River, near Puerto Sierra, January, 1903, *Wilson* 75 (N).

EL SALVADOR: Without definite locality, *Renson* 27 (N).

COSTA RICA: Taboga, January, 1913, *Jiménez* 789 (N).

PANAMA: Along Río Dupí, eastern Chiriquí, near sea level, December, 1911, *Pittier* 2539 (N). Along Río Fató, Province of Colón, alt. 10 to 100 meters, 1911, *Pittier* 3880 (N). Hospital grounds at Ancón, July, 1911, *Pittier* 3953 (N). Monte Lirio, Gatún River, Canal Zone, July, 1911, *Goldman* 1856 (N).

COLOMBIA: Santa Marta, alt. 660 meters, *H. H. Smith* 1457 (N, G, F), 2663 (N). San Martín de Loba, Department of Bolívar, 1916, *Curran* 6 (N).

Known in El Salvador as "amate de hijo grande."

There is little doubt that the specimens cited belong to Kunth's species. Whether that is the same as Martius's *Ficus anthelmintica* is not certain, in spite of the fact that Miquel considered them identical. At any rate, the specific name used by Martius is a homonym and not available.

Ficus anthelmintica was reported by Liebmann¹ from Veracruz. Whether the specimens so determined belong to *F. glabrata* can not be ascertained without an examination of his material.

6. *Ficus mexicana* Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 299. 1867.

Pharmacosycea mexicana Miquel, Versl. Med. Kon. Akad. Amsterdam 13: 416. 1862.

Large tree; bark pale brownish or yellowish; young branches stout, brown or dull grayish brown, usually glabrous but sometimes sparsely puberulent, the epidermis very tardily if at all exfoliating; stipules nearly linear, 3.5 to 10 cm. long, attenuate, green, glabrous; petioles stout or slender, 1.2 to 3.5 cm. long, scaberulo-puberulent or glabrous, canaliculate; leaf blades oval, elliptic-oval, or elliptic-oblong, broadest at or slightly below the middle, 8 to 20 cm. long, 2.8 to 8 cm. wide, obtuse at the base and 3-nerved, not at all emarginate, gradually narrowed to the acute or subacuminate apex, subcoriaceous, glaucous green, scaberulous on both surfaces or finally glabrate, the lateral veins prominent beneath, 12 to 17 on each side, slender, divergent at an angle of about 70 degrees, parallel, nearly straight, laxly anastomosing near the margin, the veinlets very inconspicuous; peduncles solitary, 3 to 8 mm. long, glabrous or nearly so; involucre very small; receptacles sometimes conspicuously stipitate, globose, about 2 cm. in diameter, spotted, sparsely scaberulous when young but soon glabrate; ostiole prominent, very small, closed by broad, obtuse, dark brown scales; sepals ferruginous.

TYPE LOCALITY: Mexico. Type collected by Schiede.

SPECIMENS EXAMINED:

SAN LUIS POTOSÍ: River banks, Tamasopo, December, 1891, a tree 15 to 18 meters high, *Pringle* 5067 (G). River banks, Micos, a tree 18 to 21 meters high, July, 1891, *Pringle* 5108 (G). Rascón, June, 1905, *Palmer* 679 (F, C).

SINALOA: Villa Unión, April, 1910, *Rose, Standley & Russell* 13924 (N), 13905 (N). Guadalupe, April, 1910, *Rose, Standley & Russell* 14772 (N). Culiacán, April, 1910, *Rose, Standley & Russell* 14911 (N).

¹ Dansk. Vid. Selsk. Skrivt. V. 2: 331. 1851.

TEPIC: Tres Marias Islands, May, 1897, *Maltby* (N). María Madre Island, May, 1897, *Nelson* 4261 (N, G). Acaponeta, on a dry hillside, April, 1910, *Rose*, *Standley & Russell* 14443 (N); June, 1897, *Rose* 3123 (N). San Juan, near Tepic, September, 1894, *Eisen* (N). Between Concepción and Acaponeta, July, 1897, *Rose* 1897 (N).

COLIMA: Colima, 1897, *Palmer* 79 (G). Plain of Colima, June, 1906, *Fernow* (G). Paso del Río, November, 1906, *Emrick* 211 (F).

JALISCO: Ixtapa, alt. 600 to 900 meters, April, 1897, *Nelson* 4138 (N).

GUERRERO: Near Iguala, by streams, alt. 900 meters, July, 1907, *Pringle* 13941 (N).

MICHOACÁN: Ostula, November, 1906, *Emrick* 107 (F).

OAXACA?: Roadside between Hacienda del Capricho, Guerrero, and Llano Grande, Oaxaca, alt. 60 to 90 meters, February, 1895, *Nelson* 2327 (N, G).

YUCATÁN: Aguada Calot yaxek, March, 1866, *Schott* 783 (F).

Those of the specimens cited which have ever been determined specifically were referred to *Ficus radula* and *F. radulina*. From the latter the present species is clearly distinct in its glabrous branches. *Ficus radula* is not known at present in Mexico except from Yucatán. *Ficus mexicana* differs from it in having gradually acute or acuminate leaf blades, but it may not be sufficiently distinct to rank as a species. Specimens reported as *Ficus radula* by Liebmann¹ from Punta de San Agustín, Oaxaca, and Hacienda de la Laguna, Veracruz, are probably *F. mexicana*.

Some variation is exhibited by the present series of specimens. In Rose's no. 1897, from Tepic, the leaf blades are very thick and are sometimes slightly lustrous on the upper surface, and the receptacles are long-stipitate. In Nelson's no. 4361, from María Madre Island, the stipules are longer than in any of the other specimens. The specimen collected by Eisen has very narrow blades.

Miquel's original specimens were without fruit, but his description of the vegetative characters agrees well with the present material. The grounds for his statement that the leaves of *F. mexicana* are narrower than those of *F. anthelmintica*, with which he compares it, are not easily understood, for judging from his own descriptions of both species the proportions of the leaf blades seem to be practically the same.

The present species is one of the strangler figs. It is very abundant on the coastal plain of Tepic and southern Sinaloa.

7. *Ficus radula* Willd. Sp. Pl. 4: 1144. 1806.

Pharmacosycea radula Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 330. 1851.

Large or small tree; branches brownish gray, the young ones ferruginous, at first sparsely puberulent but soon glabrate; stipules lance-triangular, 10 to 15 mm. long, long-attenuate, minutely puberulent or glabrous; petioles stout, 0.6 to 2.8 cm. long, glabrous or nearly so, ferruginous or grayish, canaliculate; leaf blades oblong, obovate, obovate-oblong, or oval, usually broadest above the middle, 8 to 16.5 cm. long, 3.5 to 8 cm. wide, narrowed to the obtuse or acutish, 5-nerved, subemarginate base, rounded or very obtuse at the apex and usually abruptly short-acuminate, the acumen obtuse or acutish, thin-coriaceous, pale green, subscaberulous above, scaberulous beneath, the lateral veins very prominent, 7 to 12 on each side, divaricate-ascending, subarcuate, anastomosing to form a submarginal vein, the veinlets prominent, closely or laxly reticulate; peduncles solitary, about 5 mm. long, stout, scabrous; involucre very small, trilobate, the lobes broadly rounded; receptacles subglobose, 1.5 to 3 cm. in diameter scabrous; ostiole very small, closed by numerous brown scales.

TYPE LOCALITY: Forests of the Orinoco and Río Negro, Venezuela. Type collected by Bonpland.

¹ Dansk. Vid. Selsk. Skrivt. V. 2: 331. 1851.

SPECIMENS EXAMINED:

YUCATÁN: Chichen Itzá, 1901, *Goldman* 552 (N, F). Puerto Morelos, in and along mangrove swamps, March, 1901, *Goldman* 614 (N, F).

COSTA RICA: Forests about Nicoya, January, 1900, *Tonduz* 13718 (N). Río Maravilla, Alajuela, alt. 925 meters, *Jiménez* 538 (N). Moin Hill, near Limón, June, 1898, *Pittier* 12403 (N). Taboga, January, 1913, *Jiménez* 798 (N).

PANAMA: Vicinity of Penonomé, 1908, *Williams* 251 (N). Chepo, Province of Panama, alt. 60 meters, October, 1911, *Pittier* 4757 (N).

COLOMBIA: Santa Marta, alt. 75 meters, *H. H. Smith* 1456 (N, G, F).

VENEZUELA: Bobures, November, 1914, *Jahn* 361 (N).

Warburg¹ reports the species also from Trinidad and Surinam.

The species of the subgenus *Pharmacosyce* are very closely related. The material at hand is not so ample as might be desired, and the writer suspects that, with a larger series of specimens, some of the species here recognized will have to be reduced to synonymy. The amount of pubescence on the leaf blades, which has been depended upon for separating the species, is not improbably an unreliable character.

8. *Ficus crassiuscula* Warb. sp. nov. in herb.

Large tree with rounded crown; young branches stout, brown, glabrous or minutely puberulent; stipules linear-oblong, 4 to 6 cm. long, 6 mm. wide at the base, long-acuminate, green or dark brown, coriaceous, glabrous, or puberulent near the base; petioles 2.5 to 4 cm. long, stout, glabrous; leaf blades oblong-obovate, broadly obovate-elliptic, or oval, 10.5 to 23 cm. long, 5 to 11 cm. wide, obtuse or rounded at the base, rounded at the apex or very obtuse, coriaceous, glabrous, often lustrous on the upper surface, the costa stout, the lateral veins conspicuous beneath, 14 to 22 on each side, divergent at an angle of 60 to 85 degrees, arcuately anastomosing near the margin, the veinlets inconspicuous; peduncles solitary, 2 cm. long, stout, glabrous; involucre small, trilobate, the lobes rounded, glabrous; receptacles obovoid-globose, 2 cm. in diameter, glabrous or nearly so, rose-colored at maturity; ostiole prominent; sepals dark ferruginous.

Type in the U. S. National Herbarium, no. 472427, collected at La Fortuna, Volcán de Irazú, Costa Rica, altitude 1,575 meters, July, 1901, by H. Pittier (no. 16150).

ADDITIONAL SPECIMENS EXAMINED:

COSTA RICA: Carrillo, January, 1908, *Tonduz* 17435 (N). Santo Domingo de Golfo Dulce, March, 1896, *Tonduz* 9887 (N).

PANAMA: Ancón, Canal Zone, November, 1913, *Mell* (N).

Native name in Costa Rica given as "chilamate."

Material of the type collection was sent by Mr. Pittier several years ago to Warburg, who assigned to it the name here published. *Ficus crassiuscula* is closely related to *F. radula*, but is distinguished by the long stipules and large, glabrous leaf blades, these not apiculate at the apex and with more numerous lateral veins.

9. *Ficus tecolutensis* (Liebm.) Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 299. 1867.

Urostigma tecolutense Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 324. 1851.

Young branches fulvous, glabrous; stipules 1 to 1.5 cm. long, long-acuminate, dark brown, glabrous, deciduous; petioles stout, 1 to 1.5 cm. long, glabrous; leaf blades oblong, elliptic-oblong, or oblong-oval, sometimes somewhat obovate, 6 to 10.5 cm. long, 2 to 4 cm. wide, obtuse at the base and sometimes subemarginate, 5-nerved, obtuse or acutish at the apex, subcoriaceous, concolorous, glabrous, the costa stout, prominent beneath, the lateral veins very slender, scarcely prominent, 7 to 9 on each side, divergent at an angle of 50 to 60 degrees, laxly anastomosing near the margin; peduncles geminate, short, stout; receptacles attached laterally near the base, depressed-globose, 5 to 8 mm. in diameter, glabrous, the ostiole depressed, 2.5 mm. broad, closed by 3 thin brown scales; involucre bilobate, inconspicuous, 5 to 6 mm. long, partly attached to the receptacle, the lobes rounded, brown, minutely puberulent or glabrate outside.

¹ In Urban, *Symb. Antill.* 3: 484. 1903.

TYPE LOCALITY: Tecoluta, Veracruz. Type collected by Liebmann.

SPECIMENS EXAMINED:

VERACRUZ: Tecoluta, *Liebmann* (G, type collection).

YUCATÁN: Buena Vista, 1899, *Gaumer* (F).

GUATEMALA: Alotenango, Department of Zacatepéquez, alt. 1,500 meters, March, 1892, *J. D. Smith* 2605 (N, G).

The Yucatán specimen has only immature receptacles, hence the determination is doubtful.

10. *Ficus eugeniaefolia* (Liebm.) Hemsl. Biol. Centr. Amer. Bot. 3: 144. 1883.

Urostigma eugeniaefolium Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 329. 1851.

Young branches fuscous, glabrous; stipules 1 to 2.5 cm. long, long-acuminate, firm, dark brown, grayish-puberulent outside or glabrate; petioles rather slender, 1.5 to 3 cm. long, glabrous; leaf blades obovate, broadly obovate, or elliptic-obovate, 5 to 10.5 cm. long, 2 to 4 cm. wide, narrowed to the obtuse 5-nerved base, obtuse, acute, or rounded at the apex, sometimes obscurely apiculate, subcoriaceous, glabrous, the costa coarse and prominent, the lateral veins slender, slightly prominent beneath, 8 to 12 on each side, divergent at an angle of 60 to 90 degrees, parallel, arcuately anastomosing near the margin; receptacles sessile, geminate, globose or depressed, about 1 cm. in diameter, glabrous, attached laterally near the base, the ostiole slightly prominent, closed by 2 valvate scales; involucre bilobate, united with the base of the receptacle, the free portion of the lobes broadly rounded, thin, glabrous, at first completely inclosing the receptacle but at maturity about two-thirds as long.

TYPE LOCALITY: Ujaras, Costa Rica. Type collected by Liebmann.

SPECIMENS EXAMINED:

EL SALVADOR: Without definite locality, *Renson* 96 (N).

Renson's collection, upon which the above description is based, agrees well with Liebmann's description, except in the length of the petioles, which is given as 4 to 8 mm. Liebmann gives the vernacular name in Costa Rica as "soto de caballo."

11. *Ficus tuerckheimii* Standley, sp. nov.

Large tree with branching trunk and elongate crown; young branches brownish, glabrous; stipules deciduous, 1.5 to 4.5 cm. long, narrow, long-acuminate, glabrous, or minutely puberulent outside; petioles 1.5 to 5.5 cm. long, stout, glabrous; leaf blades oval or oval-oblong, 8.5 to 17 cm. long, 4 to 9.5 cm. wide, obtuse or rounded at the base or rarely acute, not at all emarginate, 5 or 7-nerved, obtuse or rounded at the apex and short-apiculate, with a broad obtuse acumen, coriaceous, glabrous, green above, slightly paler beneath, the costa coarse and very prominent, the lateral veins slightly prominent beneath but slender, 7 to 9 on each side, divergent at an angle of 45 to 50 degrees, nearly straight, laxly anastomosing near the margin; receptacles geminate, sessile, attached laterally near the base, depressed-globose, 8 to 10 mm. in diameter, often more or less compressed laterally, glabrous or sparsely puberulent, the ostiole not prominent, closed by 2 dark brown valvate scales; involucre bilobate, united with the base of the receptacle, the free portion of the lobes broadly rounded, minutely puberulent or glabrate, at maturity about two-thirds the length of the receptacle, at anthesis equaling and closely inclosing the receptacle.

Type in the U. S. National Herbarium, no. 472426, collected at La Fortuna, Volcán de Irazú, Costa Rica, altitude 1,575 meters, July, 1901, by H. Pittier (no. 16149).

ADDITIONAL SPECIMENS EXAMINED:

GUATEMALA: Cobán, alt. 1,350 meters, December, 1907, *von Tuerckheim* II. 2092 (N).

COSTA RICA: Río Turrialba, Province of Cartago, alt. 500 meters, March, 1894, *J. D. Smith* 4937 (N, G).

Ficus tuerckheimii is closely related to *F. jimenezii*, but differs in the larger, proportionally narrower, pointed leaf blades with more prominent venation.

12. *Ficus isophlebia* Standley, sp. nov.

Tree of medium size; young branches fulvous or brownish, glabrous; stipules 2 to 4 cm. long, narrow, long-acuminate, firm, brown, glabrous; petioles stout, 3 to 4 cm. long, glabrous; leaf blades broadly obovate-oval or orbicular-obovate, 7 to 9.5 cm. long, 5 to 7 cm. wide, rounded and deeply emarginate at the 5-nerved base, broadly rounded at the apex, subcoriaceous, glabrous, bright green, concolorous, the costa prominent beneath, the lateral veins evident but scarcely elevated, 6 to 8 on each side, divergent at an angle of 50 to 60 degrees, nearly straight, arcuately anastomosing near the margin; receptacles geminate, sessile, attached laterally near the base, subglobose, more or less laterally compressed, about 9 mm. in diameter, puberulent or glabrate, the ostiole prominent, closed by 3 dark brown scales; involucre covering and attached to the lower third of the receptacle, the free portion bilobate, the lobes very thin, rounded, glabrous or sparsely puberulent.

Type in the U. S. National Herbarium, no. 676949, collected in the vicinity of David, Chiriquí, Panama, altitude 30 to 80 meters, February 25, 1911, by H. Pittier (no. 2821).

A specimen from Charco, Costa Rica, *Jiménez* 1001, is referred here doubtfully.

Ficus isophlebia is related to *F. jimenezii* but differs in having the leaf blades deeply emarginate at the base and more conspicuously veined. The receptacles have an excentric point of attachment as in that species, but the point is basal rather than lateral. The few receptacles present on the type specimen, moreover, are not at all depressed.

13. *Ficus jimenezii* Standley, sp. nov.

Young branches grayish or fulvous, glabrous; stipules 1 to 1.5 cm. long, broad, acuminate, dark brown, grayish-puberulent outside, deciduous; petioles stout, 1.7 to 3 cm. long, glabrous; leaf blades obovate-oval, oval, or oblong-obovate, 4.5 to 11 cm. long, 3.5 to 6 cm. wide, rounded or very obtuse at the base, not at all emarginate, broadly rounded at the apex, coriaceous, dull green, concolorous, glabrous, the costa coarse and slightly prominent beneath, the lateral veins very slender, immersed, 6 to 9 on each side, divergent at an angle of 55 to 80 degrees, arcuately anastomosing near the margin; receptacles geminate, sessile, attached laterally, depressed-globose, 5 to 8 mm. in diameter, glabrous or minutely puberulent, the ostiole prominent; involucre bilobate, the lobes broadly rounded, thin, minutely puberulent outside or glabrate.

Type in the U. S. National Herbarium, no. 861424, collected in the vicinity of San José, Costa Rica, November, 1910, by A. Tonduz and Otón Jiménez (no. 17536).

ADDITIONAL SPECIMENS EXAMINED:

COSTA RICA: Vicinity of San José, November, 1910, *Tonduz & Jiménez* 17537 (N), 17544 (N). Without locality, November, 1910, *Herb. Nac. Costa Rica* 17547 (N). San Francisco de Guadalupe, October, 1910, *Jiménez* 15 (N).

Ficus jimenezii is not very closely related to any Central American species heretofore published. It is remarkable for the strongly excentric attachment of the receptacles, these, although decidedly depressed, being so attached that their axis is parallel to that of the branch. The involucre is bilobate, but instead of being free from the receptacle, as in most species, it is firmly attached to it over a large portion of its surface.

14. *Ficus intramarginalis* (Liebm.) Miquel, Ann. Mus. Bot. Lugd. Bat. 3:297. 1867.

Urostigma intramarginale Liebm. Dansk. Vid. Se sk. Skrivt. V. 2: 328. 1851.

Large tree; young branches stout, trigonous, rugose, glabrous; leaves approximate, the petioles subcompressed, 5 to 6 cm. long, striate, pubescent; stipules 5 cm. long, elongate, puberulent; leaf blades ovate or elongate-ovate, 20 to 30 cm. long, 14 to 18 cm. wide, subcordate at the base and 7-nerved, subobtuse at the apex, bright green, lustrous and glabrous on the upper surface, beneath fulvous green, pubescent, fulvous-

lanate along the nerves, becoming glabrate, the lateral veins prominent beneath, 14 on each side, parallel, arcuately anastomosing near the margin, the veinlets reticulate; receptacles sessile, depressed-globose, 12 mm. long, 24 mm. broad, subpilose, finally glabrate; ostiole closed by 2 rufous-pilose scales; involucre bilobate, the lobes ovate, obtuse, fulvous-pilose.

TYPE LOCALITY: Turrialba, Costa Rica. Type collected by Örsted.

There is probably to be referred here a specimen collected near Cachí, Reventazón Valley, Costa Rica, at an altitude of 1,000 meters, March, 1902, by Brade (no. 16349). This locality is in the same region as Turrialba. Unfortunately, the specimen consists only of leaf blades, but these agree well with Liebmann's diagnosis except that they are even larger than in his specimens.

Ficus intramarginalis has the largest leaves of all the North American species. The blades of Brade's collection are 33 and 36 cm. long and 21 and 25 cm. wide, acutish at the apex, and with 13 or 14 lateral veins on each side.

15. *Ficus cookii* Standley, sp. nov.

Branches very stout, gray or brown, the young ones minutely puberulent or glabrate; stipules deciduous, 10 to 16 mm. long, broad, brown, obscurely puberulent or glabrous; petioles stout, 2.5 to 7.5 cm. long, glabrous; leaf blades broadly oval to rounded-oval or orbicular-ovate, 6 to 11 cm. long, 4.4 to 8.5 cm. wide, shallowly cordate at the base and 5 or 7-nerved, broadly rounded at the apex and sometimes very shortly apiculate, coriaceous, green above, slightly paler beneath, glabrous or when young slightly puberulent beneath, the lateral veins 8 to 10 on each side, coarse, divergent at an angle of 65 to 85 degrees, nearly straight, arcuately anastomosing near the margin; receptacles geminate, subglobose, about 1 cm. in diameter, red or pinkish, glabrous, the ostiole slightly elevated, closed by 3 broad thick bracts; involucre about two-thirds as long as the receptacle and closely investing it, bilobate, the lobes broadly rounded, brown, rigid, finely puberulent outside; receptacles partly sessile and partly pedunculate, the stout peduncles equaling or shorter than the receptacles.

Type in the U. S. National Herbarium, no. 860257, collected at San Vicente, Chiapas, Mexico, June 5, 1906, by O. F. Cook (no. 73).

ADDITIONAL SPECIMENS EXAMINED:

CHIAPAS: San Vicente, June, 1906, *Cook* 74 (N); April, 1904, *Goldman* 891 (N).

Soyotitán, March, 1904, *Goldman* 781 (N). Comitán, April, 1904, *Goldman* 832 (N); June, 1906, *Cook* 108 (N).

GUATEMALA: San Andrés, Huehuetenango, May, 1906, *Cook* 52 (N).

Ficus cookii differs from all the other species of Mexico and Central America in having both sessile and pedunculate receptacles. In some respects it answers to the description of *F. calyculata* Mill., but the diagnosis of that species is too incomplete to admit of a reliable identification. Moreover, Miller's statement that the fruit of his plant was "the size of a middling nutmeg" seems to indicate some species with larger receptacles.

16. *Ficus panamensis* Standley, sp. nov.

Young branches brownish, puberulent or glabrous; stipules about 2 cm. long, deciduous, narrow, grayish-puberulent outside; petioles rather slender, 1 to 3.5 cm. long, minutely puberulent or glabrate; leaf blades narrowly obovate-oblong or sometimes oblong, 9 to 16.5 cm. long, 4 to 5.5 cm. wide, obtuse or rounded and emarginate at the base, rounded and abruptly cuspidate at the apex, the narrow acumen 8 to 12 mm. long, obtuse or acute, green on both surfaces, sublustrous on the upper surface, thin, glabrous; receptacles geminate, sessile, subglobose, about 1 cm. in diameter, slightly longer than broad, glabrous, the ostiole prominent, closed by 2 large and one very small bract, these suberect, the receptacle thus mamillate at the apex; involucre bilobate, about 6 mm. long, the lobes rounded, minutely puberulent, spreading.

Type in the U. S. National Herbarium, no. 678988, collected along the Río Fató, Province of Colón, Panama, altitude 10 to 100 meters, epiphytic upon a tall *Sloanea*, July or August, 1911, by H. Pittier (no. 3908).

ADDITIONAL SPECIMENS EXAMINED:

TABASCO: Near Atasta, December, 1889, *Rovirosa* 682 (N).

HONDURAS: Along bank of Highland Creek, Puerto Sierra, January, 1903, *Wilson* 44 (N).

PANAMA: Río Fató, Province of Colón, 1911, *Pittier* 3893 (N).

COLOMBIA: Santa Marta, *H. H. Smith* 2106 (N, G, F).

Ficus panamensis is similar in most characters to *F. hemsleyana* (see p. 29), but is distinguished by its sessile or nearly sessile receptacles. The leaf blades, too, are narrower and have a longer, narrower acumen.

17. *Ficus williamsii* Standley, sp. nov.

Small tree; branches grayish, the young ones stout, puberulent, becoming glabrate; stipules triangular-oblong, 13 mm. long, thin, dark brown, strigose outside with stiff fulvous hairs; petioles stout, 1.5 to 2 cm. long, pruinose; leaf blades oblong or elliptic-oblong, 10 to 14 cm. long, 5.3 to 6.3 cm. wide, slightly narrowed toward both ends, obtuse at the base, subemarginate and 3-nerved, obtuse at the apex and acutely short-apiculate, coriaceous, glabrous, lustrous on the upper surface, the lateral veins prominent beneath, 9 or 10 on each side, distant, divergent at an angle of 60 degrees, straight, laxly and arcuately anastomosing near the margin, the veinlets obscure; receptacles geminate, sessile, subglobose (very immature in specimen), 12 to 14 mm. in diameter, densely and minutely grayish-puberulent, the ostiole not prominent, triangular, 2.5 mm. broad; involucre bilobate, 11 mm. broad, the lobes rounded, thin, brown, pruinose-puberulent; sepals ferruginous.

Type in the U. S. National Herbarium, no. 678105, collected in the vicinity of Penonomé, Panama, February or March, 1908, by R. S. Williams (no. 404).

In leaf texture this resembles *Ficus goldmanii*, but that has proportionally narrower leaves and different receptacles, which are borne on long peduncles.

18. *Ficus inamoena* Standley, sp. nov.

Older branches brownish gray, the young ones pale brownish, hirtellous with whitish hairs; stipules broadly triangular, 5 to 7 mm. long, acute, ferruginous, puberulent and sparsely strigose on the outer surface; petioles stout, 8 to 15 mm. long, hirtellous, deeply canaliculate; leaf blades rounded-oval, broadest slightly above the middle, 6 to 9 cm. long, 4.5 to 6.5 cm. wide, deeply cordate at the base, the sinus very narrow or the lobes slightly overlapping, broadly rounded at the apex and sometimes subemarginate, coriaceous, grayish green, short-hirtellous on both surfaces and velvety to the touch, the lateral veins prominent on both surfaces, 5 or 6 on each side, distant, divergent-ascending, slightly arcuate, laxly anastomosing near the margin, the costa anastomosing below the apex with the lateral veins, the veinlets very conspicuous, coarsely reticulate; receptacles geminate, sessile, depressed-globose, 10 to 11 mm. broad, glabrous, the ostiole not elevated, 2 mm. broad, closed by 2 truncate scales; involucre bilobate, the lobes rounded, pilose-strigose; sepals ferruginous.

Type in the U. S. National Herbarium, no. 860244, collected at Joyabaj (El Quiché), Guatemala, May 11, 1906, by O. F. Cook (no. 22).

Related to *Ficus cotinifolia*, but amply distinct in the deeply cordate leaf blades and small involucre. From *F. kellermanii* it is distinguished by the deeply cordate, broader, more pubescent leaf blades.

19. *Ficus colubrinae* Standley, sp. nov.

Older branches grayish or light brown, the young ones stout or often slender, densely pilose-strigose with long sordid hairs, tardily glabrate; stipules narrowly triangular, 5 to 8 mm. long, long-acuminate, densely pilose-strigose outside, or glabrate above, thin, ferruginous; petioles stout, 8 to 24 mm. long, densely pilose-strigose; leaf blades

oval, obovate-oval, or oval-oblong, 4.5 to 9.5 cm. long, 2.2 to 5.2 cm. wide, rounded or very obtuse at the base, usually 5-nerved, sometimes subemarginate, rounded or very obtuse at the apex and very abruptly contracted into a triangular, obtuse or acutish acumen 1 cm. long or shorter, subcoriaceous, deep green, concolorous, finely punctate on the upper surface, pilose-strigose along the veins beneath, elsewhere obscurely puberulent, glabrate in age, the lateral veins prominent beneath, 2 or 3 or rarely 4 on each side, strongly ascending, arcuate, laxly anastomosing near the margin, the veinlets inconspicuous; receptacles geminate, sessile, subglobose, 5 to 6.5 mm. in diameter, glabrous, green streaked with red, the ostiole not prominent, closed by 3 very broad obtuse scales; involucre very small, bilobate, the lobes rounded, pilose at the base with rigid hairs; sepals blackish brown.

Type in the U. S. National Herbarium, no. 860679, collected at Cubilquitz, Department of Alta Verapaz, Guatemala, altitude 350 meters, July, 1907, by H. von Türckheim (no. II. 156; distributed as *Ficus sapida*).

ADDITIONAL SPECIMENS EXAMINED:

GUATEMALA: Near the Finca Sepacuité, Department of Alta Verapaz, March, 1902, *Cook & Griggs* 26 (N). Cubilquitz, alt. 350 meters, 1900, *von Türckheim* (J. D. Smith, no. 7668; distributed as *F. hartwegii*) (N, G).

COSTA RICA: In pasture bordering road, Buena Vista, road to San Carlos Valley, alt. 600 meters, April, 1903, *Cook & Doyle* 116 (N). Santa Clara, September, 1896, *Cooper* 10242 (N). Forêts de Las Vueltas, Tucurrique, alt. 635 to 700 meters, March, 1899, *Tonduz* 13284 (N).

Known in Guatemala as "mato palo."

This species has been confused with *Ficus hartwegii* Miquel, a Colombian plant, to which it appears to be related, but which differs in having pubescent receptacles, more numerous lateral veins, and a different kind of pubescence on the branches and leaves. The leaves suggest those of some species of the genus *Colubrina*, hence the specific name.

20. *Ficus costaricana* (Liebm.) Miquel, Ann. Mus. Bot. Lugd. Bat. **3**: 298. 1867.

Urostigma costaricanum Liebm. Dansk. Vid. Selsk. Skrivt. V. **2**: 322. 1851.

?*Urostigma warzewiczii* Miquel, Versl. Med. Kon. Akad. Amsterdam **13**: 410. 1862,

?*Ficus warzewiczii* Miquel, Ann. Mus. Bot. Lugd. Bat. **3**: 298. 1867.

Tree of large or medium size; young branches stout, grayish or brownish, glabrous or sometimes hirsute when young; stipules 0.8 to 2.5 cm. long, persistent or finally deciduous, broad, brown, thin, the outer ones densely silky-strigose outside; petioles stout, 1 to 3.5 cm. long, glabrous; leaf blades narrowly obovate-oblong, or sometimes obovate, oblong, or elliptic-oblong, 6 to 15.5 cm. long, 2.5 to 6.5 cm. wide, rounded and emarginate or subcordate at the base and usually 5-nerved, rounded or obtuse at the apex or rarely acutish or obtusely short-apiculate, glabrous, coriaceous, concolorous or nearly so, the lateral veins very coarse and prominent beneath, 5 to 7 on each side, divergent at an angle of about 60 degrees, arcuate, laxly anastomosing near the margin; receptacles geminate, sessile, depressed-globose, 10 to 12 mm. in diameter, glabrous, the ostiole not prominent, closed by 2 bracts; involucre bilobate, about 1 cm. long, the lobes rounded, strigose outside.

TYPE LOCALITY: Pitayaya, Costa Rica. Type collected by Örsted.

SPECIMENS EXAMINED:

GUATEMALA: Santa Rosa, Department of Santa Rosa, alt. 1,000 meters, May, 1892, *Heyde & Lux* (J. D. Smith, no. 2983; distributed as *F. lapathifolia*) (N).

COSTA RICA: Río Torres, November, 1910, *Herb. Nac. Costa Rica* 17510 (N), 17549 (N); November, 1910, *Tonduz & Jiménez* 17535 (N). Without locality, *Herb. Nac. Costa Rica* 17548 (N); in 1888, *Biolley* 997 (N). San José, November, 1910, *Tonduz & Jiménez* 17540 (N); June, 1911, *Pittier* 3673 (N), 3675 (N); November, 1901, *Pittier* 16218 (N); May, 1890, *Pittier* 2516 (N). San Gabriel,

November, 1910, *Herb. Nac. Costa Rica* 17546; October, 1910, along roadside, *Jiménez* 14 (N). Nuestro Amo, Llanos de Turúcares, alt. 750 meters, June, 1902, *Pittier* 16394 (N); July, 1912, *Jiménez* 515 (N). Río Maravilla, Alajuela, alt. 925 meters, February, 1910, *Jiménez* 537 (N), 539 (N), 540 (N). Alajuela, alt. 900 meters, February, 1911, *Jiménez* 987 (N). Bords du Río Torres à San Francisco de Guadalupe, alt. 1,200 meters, August, 1897, *Tonduz* 11298 (N).

PANAMA: David, Chiriquí, alt. 30 to 80 meters, February, 1911, *Pittier* 2826 (N), 2835 (N). Caldera, Chiriquí, alt. 200 to 300 meters, March, 1911, *Pittier* 3348 (N).

The vernacular name in Costa Rica is given as "higuerón" and "higuerón colorado," the latter referring, presumably, to a red fruit. The receptacles of the Panama tree are said to be yellow.

21. *Ficus kellermanii* Standley, sp. nov.

Young branches grayish or yellowish brown, at first sparsely pilose but soon glabrate; stipules 1 to 2 cm. long, broad, thin, brown, puberulent outside or glabrous, deciduous; petioles 1.5 to 3 cm. long, stout, glabrous; leaf blades oval-oblong, obovate-oval, or oval, 5 to 14 cm. long, 3 to 8 cm. wide, rounded and usually emarginate or subcordate at the base, 5-nerved, rounded at the apex, coriaceous, concolorous, usually lustrous on the upper surface and glabrous or nearly so, beneath short-hirtellous, especially along the veins, or glabrate, the veins prominent beneath, the lateral ones 4 to 7 on each side, divergent at an angle of 45 to 55 degrees, straight or slightly arcuate, arcuately anastomosing near the margin; receptacles geminate, sessile, globose, 8 to 10 mm. in diameter, glabrous, the ostiole small, rather prominent, closed by 2 dark brown scales; involucre bilobate, about 5 mm. long, inconspicuous, the lobes rounded, sparsely sericeous or glabrate.

Type in the U. S. National Herbarium, no. 578685, collected at El Rancho, Department of Jalapa, Guatemala, January 6, 1906, by W. A. Kellerman (no. 5595).

ADDITIONAL SPECIMENS EXAMINED:

GUATEMALA: El Rancho, April, 1902, *Cook* 812 (N). Sanarate, Department of Guatemala, January, 1906, *Kellerman* 5902 (N). Casillas, Department of Santa Rosa, alt. 1,300 meters, May, 1893, *Heyde & Lux* (J. D. Smith, no. 4588) (N, G). Santa Rosa, alt. 1,000 meters, May, 1892, *Heyde & Lux* (J. D. Smith, no. 2983) (G). Lake Amatitlán, alt. 1,200 meters, January, 1906, *Kellerman* 5059 (N).

The native name is given by Cook as "capulín amate."

The Heyde and Lux collections were distributed as *Ficus lapathifolia* and *F. hartwegii*. The former species has much larger, pedunculate receptacles. *Ficus hartwegii* is a very different plant, native to Colombia.

Ficus kellermanii is most closely related to *F. cotinifolia*, but that species has dull leaf blades and conspicuous involucre half as long as the receptacles or even longer.

22. *Ficus cotinifolia* H. B. K. Nov. Gen. & Sp. 2: 49. 1817.

Ficus myxaefolia Kunth & Bouché, Ind. Sem. Hort. Berol. 18. 1846.

Urostigma cotinifolium Miquel, Lond. Journ. Bot. 6: 530. 1847.

Urostigma longipes Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 321. 1851.

Urostigma glaucum Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 322. 1851.

Urostigma myxaefolium Miquel, Versl. Med. Kon. Akad. Amsterdam 13: 410. 1862.

Ficus longipes Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 297. 1867, not *F. longipes* Griffith, 1854.

Ficus glauca Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 299. 1867, not *F. glauca* DuRoi. de Cours. 1811.

Ficus subrotundifolia Greenm. Proc. Amer. Acad. 41: 237. 1905.

Large or small tree with gray bark; young branches brownish, tomentulose, especially about the nodes, glabrate in age; stipules ovate-triangular, 5 to 13 mm. long,

acute, densely sericeous outside with white or yellowish hairs, thin, dark brown; petioles slender or stout, 1 to 6 cm. long, tomentulose when young but soon glabrate, canaliculate; leaf blades oblong, oval, obovate-oval, rounded-oblong, or suborbicular, usually broadest slightly above the middle, 5 to 13 cm. long, 2.2 to 10 cm. wide, rounded at the base or subcordate, 5-nerved, broadly rounded at the apex and sometimes subemarginate, rarely acutish, coriaceous or subcoriaceous, pale or deep green, glabrous or tomentulose on the upper surface, densely tomentulose or short-villous beneath or sometimes only sparsely pilose, often nearly glabrous in age, the lateral veins prominent beneath, 5 to 7 on each side, distant, nearly straight or sometimes slightly tortuous, ascending at an angle of about 45 degrees, laxly anastomosing near the margin, the veinlets very conspicuous, coarsely reticulate; receptacles geminate, sessile, globose or slightly depressed, 6 to 11 mm. in diameter, spotted, finely and densely sericeous or in age glabrate, the ostiole not prominent, 2 mm. broad, closed by 2 truncate brown scales; involucre bilobate, half as long as the receptacle, the lobes rounded to acutish, densely and finely white-sericeous on both surfaces; sepals ferruginous.

TYPE LOCALITY: On the Acapulco road near La Venta del Egido, Mexico. Type collected by Bonpland.

SPECIMENS EXAMINED:

CHIHUAHUA: Hacienda San Miguel, 1885, *Palmer* I (N, G).

SONORA: Alamos, January, 1899, *Goldman* 287 (N, G). Sierra de Alamos, near the summit, March, 1910, *Rose, Standley & Russell* 12875 (N).

LOWER CALIFORNIA: Miraflores, alt. 300 meters, October, 1894, *Eisen* (N).

SINALOA: Near Colomas, July, 1897, *Rose* 1704 (N), 1770 (N). Culiacán, September 13, 1904, *Brandeggee* (C).

JALISCO: Near Guadalajara, September, 1891, *Pringle* 3887 (N, G, F); September, 1903, *Rose & Painter* 7365 (N), *Pringle* 11850 (G, N).

TEPIC: Acaponeta, April, 1910, *Rose, Standley & Russell* 14442 (N). María Madre Island, May, 1897, *Nelson* 4182 (N), *Maltby* 78 (N).

SAN LUIS POTOSÍ: Near Los Canos, September, 1902, *Palmer* 227 (N, G, F).

TAMAULIPAS: Vicinity of Tampico, alt. 15 meters, 1910, *Palmer* 199 (N). Vicinity of Victoria, alt. 320 meters, 1907, *Palmer* 28 (N, G, C).

VERACRUZ: Colipa, *Liebmann* (G, type collection of *Urostigma longipes*).

COLIMA: Manzanillo, March, 1891, *Palmer* 1387 (N, G). Socorro Island, 1903, *Barkelaw* 178 (N, G, C); in 1897, *Anthony* 395 (N, G, C).

PUEBLA: Near Tehuacán, 1911, *Purpus* 5729 (C); in 1905, *Rose, Painter & Rose* 9880 (N), 9881 (N), 9879 (N); December, 1895, *Pringle* 7041 (N, G); May, 1908, *Brandeggee* 3386 (C). Between Huajuapám, Oaxaca, and Retlatzingo, Puebla, alt. 1,440 to 1,950 meters, November, 1894, *Nelson* 1993 (N, G). Tochimilco, August, 1893, *Nelson* (N).

MORELOS: Near Cuernavaca, May, 1899, *Rose & Hough* 4355 (N); June, 1904, *Pringle* 8931 (N, G, type of *F. subrotundifolia*, F).

OAXACA: Valley about Cuicatlán, alt. 540 meters, November, 1894, *Nelson* 1860 (N, G). Mitla, September, 1906, *Rose & Rose* 11316 (N).

YUCATÁN: Without locality, *Gaumer* 599 (N, G, F). Izamal, February, 1906, *Greenman* 423 (N, G, F). Chichen Itzá, 1901, *Goldman* 553 (N, F); February, 1899, *Millspaugh* 1630 (F). Hacienda San Rafael, August, 1865, *Schott* 846 (F). Maxcanú, April, 1903, *C. & E. Seler* 4021 (F). Motul, March, 1903, *C. & E. Seler* 3950 (N, F).

COSTA RICA: Nuestro Amo, alt. 500 meters, July, 1912, *Jiménez* 514 (N). Alajuela, alt. 900 meters, January, 1910, *Jiménez* 1007 (N). Nicoya, 1900, *Tonduz* (N).

The native names in Yucatán are given as "álamo," "kopó," and "coobo."

This species ranges nearly throughout Mexico and naturally so numerous specimens exhibit great variation. At first glance the form with nearly glabrous leaves described by Kunth as *Ficus cotinifolia* seems very different from the plant with densely hairy leaves to which Liebmann applied the name *longipes*. In the writer's mind, however, there is no doubt that all the specimens listed are conspecific. The leaf blades show much variation in outline, but often the range of variation upon a single specimen is nearly as great as in the whole series of specimens examined.

Ficus myxaefolia was described from cultivated specimens. The dimensions of the leaves (up to 17 cm.) are much greater than in our specimens, yet this size could easily be explained as the result of favorable cultural conditions. When Miquel transferred the species to *Urostigma* he referred to it Schiede and Deppe's no. 737, probably from Veracruz, giving a complete description of the plant. His diagnosis agrees very well with the less pubescent specimens here listed. If Miquel was correct in his identification, as very probably he was, being an intensive student of this genus, there is little doubt that *Ficus myxaefolia* is properly placed in synonymy here. The specific name, derived from an old generic name applied to certain species of *Cordia*, would indicate a plant with leaves similar to those of *Ficus cotinifolia*.

The description of *Urostigma glaucum* agrees in every detail with the present material. The type of this species was collected by Liebmann along the Río de las Vueltas, Oaxaca.

Many of the specimens cited have been distributed as *Ficus tecolutensis*, sometimes with a note to the effect that the receptacles are, however, sessile. That species, as shown by a specimen of the type collection in the Gray Herbarium, is a wholly different plant.

Rose's no. 11316 from Mitla, Oaxaca, is remarkable in having petioles up to 11.5 cm. long, which thus equal or exceed the blades. Otherwise it does not appear to differ from typical *cotinifolia*. In most specimens the petioles are much shorter than the leaf blades.

23. *Ficus petiolaris* H. B. K. Nov. Gen. & Sp. 2: 49. 1817.

Urostigma petiolare Miquel, Lond. Journ. Bot. 6: 527. 1847.

Ficus jaliscana S. Wats. Proc. Amer. Acad. 26: 150. 1891.

Small or large tree with stout, thick, grayish or yellowish branches, the branchlets glabrous; petioles slender, half as long as the blades or longer, often equaling them; stipules brown, glabrous or sparsely puberulent, large; leaf blades cordate-orbicular, 6.5 to 15 cm. broad, broadly rounded at the apex and abruptly short-apiculate, the basal sinus deep and narrow, the rounded lobes sometimes overlapping, the upper surface of the blades glabrous, pale green or glaucous, the lower surface pale, glabrous except for tufts of long white hairs in the axils of the principal veins; peduncles geminate, 7 to 20 mm. long, glabrous; involucre bilobate, the lobes short, rounded, puberulent; receptacles globose or depressed-globose, 10 to 15 mm. in diameter, densely fulvous-villous when young, in age minutely puberulent or glabrate, sometimes spotted, the ostiole prominent.

TYPE LOCALITY: Western slope of the Sierra Madre near Mazatlán, Sinaloa, and Acahuizatlá, Guerrero. Type collected by Bonpland.

SPECIMENS EXAMINED.

SONORA: Granados, alt. 1,110 meters, 1894, *Hartman* 217 (N, G, F). Alamos, 1899, *Goldman* 286 (N, G). Sierra de Alamos, 1910, *Rose, Standley & Russell* 12810 (N). Mina Grande, April, 1892, *Eisen* (C).

SINALOA: Near Colomas, 1897, *Rose* 1695 (N), 3192 (N). Mazatlán, 1910, *Rose, Standley & Russell* 13744 (N). Valley of Río Fuerte, 1898, *Goldman* 243 (N, G). Topolobampo, 1910, *Rose, Standley & Russell* 13284 (N).

JALISCO: Bolaños, 1897, *Rose* 2908 (N). Barranca near Guadalajara, 1892, *Pringle* 4336 (N, F). Cliffs near Guadalajara, December, 1889, *Pringle* 2932 (G, type of *F. jaliscana*).

GUERRERO: Near Iguala, 1905, *Rose, Painter & Rose* 9400 (N). Between Tlapa and Ayusinapa, alt. 1,350 to 1,710 meters, 1894, *Nelson* 2099 (N, G).

MORELOS: Cuernavaca, 1904, *Pringle* 13196 (distributed as *F. guadalajarana*) (N, G, F).

This tree is abundant all along the western coast of Mexico, growing on dry slopes, often on the face of cliffs. It is perhaps the most distinct of all the Mexican species, being strongly marked by the tufts of long white hairs on the lower surface of the leaves, as well as by the leaf outline.

The type of *Ficus jaliscana* was collected on cliffs near Guadalajara by Pringle (no. 2932). It seems strange that Watson did not associate Pringle's specimens with the species so accurately described by Kunth.

Here, doubtless, is to be placed Seemann's no. 1459, from Mazatlán, Mexico, referred doubtfully to *Ficus nymphaeifolia* L. by Hemsley.¹ That species somewhat resembles *F. petiolaris*, but is very distinct. It has been collected recently in Colombia (*H. H. Smith* 1455).

24. *Ficus donnell-smithii* Standley, sp. nov.

Small tree, 4 to 5 meters high; branches slender, dark grayish brown, the young ones paler, finely and densely puberulent or short-hirtellous, tardily glabrate; stipules narrowly triangular, acuminate, 5 to 7 mm. long, finely sericeous-puberulent; petioles slender, 7 to 18 mm. long, puberulent; leaf blades oblong-elliptic to very narrowly oblong or lance-oblong, 7 to 15 cm. long, 1.8 to 2.7 cm. wide, slightly narrowed to the obtuse subemarginate 3-nerved base, usually gradually tapering to the acuminate or long-acuminate apex but sometimes obtuse or rounded, dark green, thin, scaberulous on the upper surface, glabrate in age, beneath pilose with very short whitish hairs, becoming glabrate, the lateral veins not prominent, 7 or 8 on each side, remote, ascending at an angle of about 45 degrees, slightly arcuate, obscurely anastomosing near the margin, the veinlets inconspicuous; peduncles geminate, slender, 6 to 7 mm. long, puberulent; involucre bilobate, 3 to 4 mm. broad, the lobes rounded, reflexed or spreading, brown, puberulent outside; receptacles subglobose, 8 to 9 mm. in diameter, puberulent but becoming glabrate, the ostiole not prominent, 2.5 mm. broad, closed by 3 broad rounded scales; sepals ferruginous.

Type in the U. S. National Herbarium, no. 576518, collected at Cubilquitz, Department of Alta Verapaz, Guatemala, altitude 350 meters, May, 1902, by H. von Türckheim (no. II. 597; J. D. Smith, no. 8289.) The same collection is represented by nos. 796063-796065 of the National Herbarium and by specimens in the Gray Herbarium and the herbarium of the Field Museum of Natural History. Also obtained at the type locality in August, 1900, by the same collector (no. 7773) (N, G).

Very distinct from all other species in its very narrow leaf blades. In some respects it agrees with the diagnosis of *Ficus guatemalana*, which was based upon plants cultivated at Berlin, obtained in Guatemala by Warscewicz. That species was described as having much larger, proportionally broader blades. While it may, nevertheless, be the same as the plant here described, judging from the description it seems more properly referable to synonymy under *F. lapathifolia* (see p. 24). Both collections here cited were distributed as *Ficus lancifolia*, but that is a very different plant (see p. 25).

25. *Ficus palmeri* S. Wats. Proc. Amer. Acad. 24: 77. 1889.

Large or small tree with yellowish bark; young branches stout, densely white-pilose, finally becoming glabrate; stipules broadly ovate-triangular, 1.5 to 2 cm. long, acuminate, thin, dark brown, glabrous; petioles mostly slender, 1.5 to 5 cm. long, short-pilose or puberulent; leaf blades very variable in outline but usually broadly ovate-deltoid, sometimes cordate-orbicular, 6 to 14 cm. long, 4 to 11.5 cm. wide, truncate to deeply cordate at the base, broadly rounded to acutish at the apex, coria-

¹ Biol. Centr. Amer. Bot. 3: 146. 1883.

ceous, glaucous green, when young densely pubescent on both surfaces with short, white, straight or crispate hairs, in age glabrate on the upper surface; peduncles geminate, 5 to 25 mm. long, densely pubescent, or glabrate in age; involucre bilobate, small, the lobes rounded, pubescent; receptacles turbinate-globose, 12 to 15 mm. in diameter, flattened on the top, densely soft-pubescent or finally glabrate, the ostiole prominent, the scales broadly triangular, obtuse; sepals pale brown.

TYPE LOCALITY: San Martín Island, Lower California. Type collected by Palmer in 1887 (no. 413).

SPECIMENS EXAMINED:

LOWER CALIFORNIA: San Martín Island, 1887, *Palmer* 413 (N, G, type, C). El Potrero, 25 miles southwest of Mulegé, alt. 180 meters, October, 1905, *Nelson & Goldman* 7234 (N). Seal Island, April, 1911, *Rose* 16817 (N). Near Calmallí, alt. 480 meters, 1898, *Purpus* 1 (N, F, C). Tiburón Island, 1895, *McGee* (N, C); April, 1911, *Rose* 16786 (N). Head of Concepción Bay, April, 1911, *Rose* 16701 (N). Santa Rosalía, 1889, *Palmer* 210 (N, G). Cape San Lucas, March, 1911, *Rose* 16387 (N). Between Cajón and El Sacatón, alt. 60 to 150 meters, December, 1905, *Nelson & Goldman* 7363 (N). Yubáy, alt. 600 meters, September, 1905, *Nelson & Goldman* 7149 (N). San Juanico, 1897, *Anthony* (F). Purísima, 1889, *Brandege* (F). San Benito, April 10, 1889, *Brandege* (C). Comandú, *Brandege* (C).

The fruit is said to be edible, but with its small amount of pulp and its hairy indument it can not be very palatable.

The species is a variable one in several respects, but especially in leaf form. In some cases the leaves are soon glabrate, but in others they retain their pubescence to maturity. Usually the blades are truncate or subcordate at the base. In some of the Tiburón Island specimens, however, they are deeply cordate, with overlapping lobes, reminding one of the leaves of *Ficus petiolaris*, although even in sterile specimens these two are easily distinguished by the difference in pubescence. In the material from Concepción Bay the peduncles are remarkably long and the receptacles small and glabrate, yet there is little doubt that the specimens are conspecific with the others cited.

In the type collection the leaves are smaller and more densely pubescent than is usual in the species.

26. *Ficus brandegei* Standley, sp. nov.

Young branches glaucous, glabrous or pruinose-puberulent, reddish brown in age; stipules narrowly triangular, 12 to 18 mm. long, long-acuminate, dark brown, glabrous; petioles stout, 1.5 to 3.5 cm. long, glabrous; leaf blades broadly deltoid-ovate, 7 to 10.5 cm. long, 5 to 8 cm. wide, subcordate or cordate at the base and 5-nerved, obtuse or broadly obtuse at the apex, coriaceous, glabrous, pale green above, glaucescent beneath, the lateral veins slender but prominent beneath, 6 to 8 on each side, divergent at an angle of 45 to 60 degrees, straight, arcuately anastomosing near the margin; peduncles geminate, 2.5 to 4 cm. long, glabrous; involucre deeply bilobate, 10 to 12 mm. long, the lobes rounded, pruinose-puberulent; receptacles globose, 1.5 cm. in diameter, glabrous, the ostiole prominent, closed by 3 suberect valvate scales.

Type in the herbarium of the University of California, no. 142205, collected at San José del Cabo, Lower California, Mexico, September 15, 1899, by T. S. Brandege. Another specimen in the same herbarium (no. 116819) was obtained at the same locality by Brandege, September 16, 1890 (no. 561).

Ficus brandegei is closely related to *F. palmeri*, also of Lower California, and may be only a form of it. The latter species, however, has copiously pubescent leaves and receptacles, and the receptacles are pyriform-globose. In *F. brandegei* the leaf blades are perfectly glabrous, even in bud, and all the receptacles appear to be globose. The latter character perhaps will not hold when a larger series of specimens has been secured. The character of the pubescence, nevertheless, seems to be sufficient for the separation of the two species, for in none of the other American species do we find

glabrous and pubescent forms. In some species, for example *F. cotinifolia*, leaves which are at first pubescent later become glabrate, but traces of the pubescence may be found even in age.

27. *Ficus pringlei* S. Wats. Proc. Amer. Acad. 26: 150. 1891.

Small or medium-sized tree; older branches reddish brown, glabrate, the young ones densely villous with fulvous hairs; stipules triangular-oblong or ovate, about 1.5 cm. long, acute, densely villous; petioles stout, 5 to 11 mm. long, villous; leaf blades ovate-oval or deltoid-ovate, 4.5 to 8 cm. long, 2.5 to 6 cm. wide, subcordate or emarginate at the base, very obtuse or sometimes rounded at the apex, thick-coriaceous, rugose, yellowish green, the upper surface finely hirtellous or in age glabrate, the lower surface densely short-villous with grayish or slightly fulvous hairs, the lateral veins prominent, usually 6 on each side, ascending at an angle of about 50 degrees, distant, nearly straight, anastomosing near the margin, the veinlets prominent, finely reticulate; peduncles geminate, stout, 2 to 4 mm. long, densely villous; involucre bilobate, the lobes rounded, nearly or quite half as long as the receptacle, appressed, densely and finely villous-sericeous on both surfaces; receptacles depressed-globose, about 1 cm. broad, finely sericeous with short white hairs when young but soon glabrate, the ostiole prominent, closed by 3 suberect, rounded, dark brown, pubescent scales; sepals dark ferruginous.

TYPE LOCALITY: In the barranca near Guadalajara, Jalisco. Type collected by Pringle, December, 1889 (no. 2928).

SPECIMENS EXAMINED:

JALISCO: Near Guadalajara, December, 1889, *Pringle* 2928 (G, type); July, 1902, *Pringle* 11174 (N, G, F); September, 1891, *Pringle* 3865 (N, G, F); September, 1903, *Pringle* 7366 (N). On the road between Bolaños and Guadalajara, September, 1897, *Rose* 3065 (N).

The fruit is said to be edible.

The specimens are very uniform, and, so far as is now known, the species is very restricted in its distribution.

28. *Ficus microchlamys* Standley, sp. nov.

Older branches nearly black, glabrate, the young ones tomentose; stipules ovate-triangular, about 7 mm. long, densely fulvous-villous; petioles stout, 10 to 13 mm. long, fulvous-tomentose; leaf blades broadly oblong, ovate-oblong, oblong-oval, or rounded-ovate, 6 to 12 cm. long, 3.5 to 7.3 cm. wide, subcordate or emarginate at the base, rounded or obtuse and very shortly apiculate at the apex, thick-coriaceous, pale green on the upper surface and villosulous along the veins or glabrate, beneath densely and loosely tomentose with fulvous or grayish hairs, the lateral veins very prominent beneath, 11 or 12 on each side, approximate, parallel, nearly straight, divergent at an angle of about 50 degrees, arcuately anastomosing near the margin, the veinlets prominent, coarsely reticulate; peduncles geminate, stout, 5 to 7 mm. long, fulvous-villous; involucre bilobate, very small, the lobes rounded, 2 to 3 mm. long, densely villous outside, glabrous within, reflexed; receptacles subglobose, 12 mm. in diameter, very densely fulvous-villous, the ostiole rather prominent; sepals dark ferruginous.

Type in the U. S. National Herbarium, no. 41638, collected on rocky bluffs of a barranca near Guadalajara, Jalisco, Mexico, October 9, 1891, by C. G. Pringle (no. 3883). Specimens of the same collection are in the Gray Herbarium and in the herbaria of the Field Museum of Natural History and the University of California.

ADDITIONAL SPECIMENS EXAMINED:

TEPIC: Tepic, 1892, *Palmer* 2006 (N).

VERACRUZ: Orizaba, *Botteri* 424 (G).

In general appearance the proposed species resembles *Ficus pringlei*, from the same locality, but in the latter the involucre is appressed and three times as large, while the pubescence of the receptacles is very different and the peduncles are much shorter.

29. *Ficus velutina* Willd. Sp. Pl. 4: 1141. 1806.

Large tree; branches brownish, the young ones fulvous-hirtellous, very stout, glabrate in age; stipules 1.5 to 2 cm. long, ovate-triangular, acuminate, fulvous or ferruginous-sericeous outside; petioles stout, 1.3 to 3.2 cm. long, villous or villous-tomentose when young, glabrate in age; leaf blades oval, ovate-oval, obovate-oval, or broadly obovate-oblong, 9 to 26 cm. long, 5.5 to 11.5 cm. wide, often slightly narrowed toward both ends, rounded, truncate, or subcordate at the base, always at least emarginate, rounded or very obtuse at the apex and usually very shortly obtuse-apiculate, pale green, the upper surface scaberulous and puberulent along the veins or in age glabrate, the lower surface at first tomentulose, becoming short-pilose, or finally glabrate, the costa stout, bearing a large black gland at the base, the lateral veins prominent, 7 to 12 on each side, ascending or divaricate, distant, subarcuate, anastomosing near the margin, the veinlets prominent, densely or coarsely reticulate; peduncles geminate, 2 to 3 mm. long, very thick, short-pilose; involucre bilobate, about 1 cm. in greatest diameter, the lobes obtuse, fulvous or ferruginous-tomentulose outside, becoming glabrate, spreading or reflexed; receptacles globose, 1.3 to 1.7 cm. in diameter, smooth or verrucose, minutely sericeous-puberulent, becoming glabrate, the ostiole rather prominent, 4 mm. broad; sepals ferruginous.

TYPE LOCALITY: Near Río Xayo and Sambingo, between Almaguer and Pasto, Colombia.¹ Type collected by Bonpland.

SPECIMENS EXAMINED:

COSTA RICA: Camino á Desamparados, November, 1910, *Tonduz & Jiménez* 17541 (N). Nuestro Amo, Hacienda de Dr. Núñez, alt. 500 meters, July, 1912, *Jiménez* 517 (N). Parque Nacional, San José, alt. 1,000 meters, November, 1901, *Pittier* 16215 (N). Alajuela, February, 1910, *Jiménez* 706 (N). Desamparados, alt. 1,180 meters, December, 1913, *Jiménez* 982 (N).

PANAMA: Sabana del Macano, Caldera, Chiriquí, alt. 200 to 300 meters, March, 1911, *Pittier* 3359 (N).

The native name in Costa Rica is given as "chilamate."

The specimens cited agree very well with the amplified description published by Kunth.¹ They exhibit a good deal of variation, especially in leaf form. The first collection cited is remarkable in having rather narrow leaf blades with divaricate lateral veins. Pittier's no. 16215, determined by Warburg as a new species, has broad blades, mostly broadest near the base, and very conspicuous veinlets.

30. *Ficus lapathifolia* (Liebm.) Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 297. 1867.

Urostigma lapathifolium Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 319. 1851.

Urostigma guatemalanum Miquel, Versl. Med. Kon. Akad. Amsterdam 13: 411. 1862.

Ficus guatemalana Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 298. 1867.

Branches dark brownish gray, the young ones puberulent and hirtellous with gray hairs, the pubescence persistent; stipules ovate-triangular or lance-triangular, 15 to 18 mm. long, densely whitish-sericeous outside, or the pubescence slightly spreading; petioles 1 to 3.2 cm. long, stout, densely puberulent and whitish-hirtellous, becoming glabrate; leaf blades oval to broadly oblong, 6 to 19 cm. long, 3.5 to 9 cm. wide, rounded or subtruncate and emarginate or subcordate at the base, 3 or 5-nerved, rounded or obtuse at the apex, often very shortly and broadly obtuse-apiculate, coriaceous, the upper surface at first copiously pubescent with short, grayish, spreading or appressed hairs, scaberulous or glabrate in age, beneath fulvous, densely pubescent with short, straight or crispate, spreading or matted hairs, sometimes becoming glabrate, the lateral veins prominent, 7 to 13 on each side, distant, straight, laxly and arcuately anastomosing near the margin, the veinlets inconspicuous, coarsely reticulate; peduncles geminate, 4 to 9 mm. long, stout, hirtellous; involucre bilobate, about

¹ H. B. K. Nov. Gen. & Sp. 2: 46. 1817.

8 mm. in greatest diameter, the lobes broadly rounded, densely sericeous outside, brown within and glabrous; receptacles globose, 15 to 22 mm. in diameter, very densely whitish-sericeous with short hairs, the ostiole not prominent, closed by 3 broad, rounded, dark brown scales; sepals dark ferruginous.

TYPE LOCALITY: Yecoatla and Colipa, Veracruz. Type collected by Liebmann.

SPECIMENS EXAMINED:

TAMAULIPAS: Tampico, alt. 15 meters, 1910, *Palmer* 198 (N).

GUERRERO: Jamiltepec to Río Verde, alt. 120 to 300 meters, February, 1895, *Nelson* 2362 (N, G).

CHIAPAS: San Vicente, April, 1904, *Goldman* 861 (N).

GUATEMALA: Amatitlán, alt. 1,170 meters, February, 1890, *J. D. Smith* 1930 (G).

The type of *Urostigma guatemalanum* was cultivated at Berlin from material collected in Guatemala by Warscewicz. Liebmann describes the leaf blades of *Urostigma lopathifolium* as being 21 to 25.5 cm. long and 13 to 15 cm. wide, which is larger than in any specimens examined by the writer, although the proportions are the same. Otherwise his description agrees well with the specimens cited.

31. *Ficus ovalis* (Liebm.) Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 298. 1867.

Urostigma ovale Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 324. 1851.

Young branches brownish, glabrous; stipules 10 to 15 mm. long, long-acuminate, thin, brown, glabrous, deciduous; petioles stout, 1 to 3.5 cm. long; leaf blades oval, oval-obovate, or obovate-oblong, 6.5 to 10.5 cm. long, 4 to 5.5 cm. wide, rounded at the base and emarginate, 3 or 5-nerved, rounded or obtuse at the apex, subcoriaceous, glabrous, green above, slightly paler beneath, the veins slender but very prominent beneath, 4 to 6 on each side, divergent at an angle of 50 to 60 degrees, arcuately anastomosing near the margin; peduncles geminate, stout, 3 to 6 mm. long; involucre bilobate, inconspicuous, about 5 mm. long, the lobes rounded, spreading, thin, brown, glabrous; receptacles globose, 6 to 8 mm. in diameter, glabrous, the ostiole slightly prominent, closed by 2 brown scales.

TYPE LOCALITY: Guanacaste, Costa Rica. Type collected by Örsted.

SPECIMENS EXAMINED:

NICARAGUA: Without definite locality, *Wright* (N, G).

The leaves of *Ficus ovalis* resemble those of *F. cotinifolia*, but in that species the receptacles are sessile.

32. *Ficus padifolia* H. B. K. Nov. Gen. & Sp. 2: 47. 1817.

Ficus complicata H. B. K. Nov. Gen. & Sp. 2: 48. 1817.

Ficus prinoides Willd. err. det. Schlecht. & Cham. Linnaea 6: 357. 1831.

Ficus lancifolia Hook. & Arn. Bot. Beechey Voy. 310. 1839, not *F. lancifolia* Moench, 1794.

?*Ficus consanguinea* Kunth & Bouché, Ind. Sem. Hort. Berol. 17. 1846.

Urostigma lancifolium Miquel, Lond. Journ. Bot. 6: 538. 1847.

Urostigma schiedeianum Miquel, Lond. Journ. Bot. 6: 539. 1847.

Urostigma padifolium Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 324. 1851.

Urostigma complicatum Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 325. 1851.

Urostigma sapidum Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 327. 1851.

Urostigma baccatum Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 327. 1851.

Urostigma turbinatum Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 328. 1851.

Urostigma liebmannianum Miquel in Seem. Bot. Voy. Herald 195. 1854.

Urostigma consanguineum Miquel, Versl. Med. Kon. Akad. Amsterdam 13: 408. 1862.

Urostigma sulcipes Miquel, Versl. Med. Kon. Akad. Amsterdam 13: 413. 1862.

Ficus turbinata Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 298. 1867, not *F. turbinata* Willd. 1805.

Ficus sapida Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 298. 1867.

Ficus liebmanniana Miquel, Ann. Mus. Bot. Lugd. Bat. **3**: 298. 1867.

Ficus sulcipes Miquel, Ann. Mus. Bot. Lugd. Bat. **3**: 298. 1867.

Ficus baccata Miquel, Ann. Mus. Bot. Lugd. Bat. **3**: 299. 1867.

Ficus fasciculata S. Wats. Proc. Amer. Acad. **24**: 78. 1889, not *F. fasciculata* King, 1888.

Ficus sonorae S. Wats. Proc. Amer. Acad. **24**: 78. 1889.

Large or small tree with pale yellowish bark; young branches rather slender, fulvous or brownish, glabrous or minutely puberulent; stipules 5 to 15 mm. long, narrow, long-acuminate or attenuate, thin, brown, deciduous, glabrous or minutely puberulent; petioles slender or stout, 5 to 30 mm. long, glabrous or minutely puberulent; leaf blades very variable in outline, oblong, elliptic-oblong, lance-oblong, lanceolate, oval, ovate, or rarely broadly ovate, 4 to 12 cm. long, 1.5 to 4.7 cm. wide, rounded or obtuse at the base, sometimes subemarginate, gradually or somewhat abruptly acute to long-acuminate at the apex or rarely obtuse, the tip of the blade acute or obtuse, coriaceous or subcoriaceous, glabrous, bright or yellowish green, concolorous, the costa prominent beneath, the lateral veins very slender, slightly prominent beneath, 5 to 12 on each side, divergent at an angle of 45 to 60 degrees, usually arcuate, laxly anastomosing near the margin, the blades usually conspicuously 3-nerved at the base, the 2 basal lateral veins commonly much more conspicuous than the other lateral ones; peduncles geminate, slender, glabrous or puberulent, sometimes longer but usually shorter than the receptacles; involucre inconspicuous, deeply bilobate, 3 to 4 mm. long, the lobes rounded, spreading, glabrous or minutely puberulent; receptacles subglobose, 9 to 12 mm. in diameter, spotted, glabrous or minutely puberulent, the ostiole deeply depressed, usually surrounded by an elevated annulus.

TYPE LOCALITY: Near Acapulco, Guerrero. Type collected by Bonpland.

ILLUSTRATION: Seem. Bot. Voy. Herald *pl.* 35.

SPECIMENS EXAMINED:

SONORA: Guaymas, November, 1887, *Palmer* 645 (N, G), 92 (G, type of *F. sonorae*, N, C), 646 (G, type of *F. fasciculata*, N); June, 1897, *Rose* 1207 (N, G); May 11, 1892, *Brandegge* (C). Sierra de Alamos, March, 1910, *Rose, Standley & Russell* 12809 (N), 12991 (N).

SINALOA: Guadalupe, April, 1910, *Rose, Standley & Russell* 14774 (N). Villa Unión, April, 1910, *Rose, Standley & Russell* 13904 (N), 13906 (N), 13947 (N). La Rastra, alt. 600 meters, March, 1899, *Goldman* 362 (N, G). Rosario, July, 1897, *Rose* 1824 (N); April, 1910, *Rose, Standley & Russell* 14646 (N). Mazatlán, March and April, 1910, *Rose, Standley & Russell* 13745 (N), 14128 (N). Valley of Río Fuerte, October, 1898, *Goldman* 244 (N, G).

TEPIC: Acaponeta, April, 1910, *Rose, Standley & Russell* 14444 (N); June, 1897, *Rose* 1452 (N). San Blas, June, 1897, *Nelson* 4342 (N). María Madre Island, May, 1897, *Nelson* 4288 (N, G). Tepic, 1892, *Palmer* 1855.

JALISCO: Near Guadalajara, September, 1891, *Pringle* 3860 (N, G, F). Casa Fuerte, April, 1905, *Griffiths* 3334 (N).

TAMAULIPAS: Tampico, alt. 15 meters, January, 1910, *Palmer* 140 (N).

SAN LUIS POTOSÍ: Tamasopo Canyon, July, 1890, *Pringle* 3554 (G, F). Las Palmas, June, 1892, *Pringle* 5305 (G).

COLIMA: Colima, 1891, *Palmer* 1119 (N, G).

MICHOACÁN?: La Providencia, alt. 900 meters, April, 1899, *Langlassé* 1014 bis (N).

GUERRERO: Between Copala and Juchitango, alt. 60 to 180 meters, February, 1895, *Nelson* 2311 (N, G). Acapulco, 1894-95, *Palmer* 62 (N, G, F).

MORELOS: Near Cuernavaca, May, 1899, *Rose & Hough* 4350 (N).

OAXACA: Valley of Oaxaca, alt. 1,530 to 1,740 meters, September, 1894, *Nelson* 1252 (N, G). Nazareno Etla, alt. 1,590 meters, June, 1895, *L. C. Smith* 489 (G). Cerro del Fule, alt. 1,600 meters, May, 1907, *Conzatti* 1805 (F). Between San Carlos and San Bartolo, alt. 900 to 1,440 meters, April, 1895,

Nelson 2562 (N, G). Between Pochutla and Plunia, alt. 150 to 750 meters, March, 1895, *Nelson* 2462 (N, G). Huanchilla, Nochixtlan, alt. 2,000 meters, June, 1901, *Conzatti & Gonzáles* 1205 (G). Cerro San Antonio, alt. 1,600 meters, October, 1906, *Conzatti* 1592 (F). Guatulco, *Liebmann* (G, type collection of *Urostigma turbinatum*).

VERACRUZ: Orizaba, *Botteri* 425 (G); July, 1857, *Mohr & Botteri* 425 (N). Zacuapán, March, 1912, *Purpus* 6625 (N, G, F, C). Maloapam, *Liebmann* (G). Papantla to Zamora, March, 1898, *Goldman* 92 (G). Wartenberg, 1858, *Ervendberg* 332 (G).

TABASCO: San Juan Bautista, June, 1889, *Rovirosa* 513 (N).

GUATEMALA: Between Salamá and Rabinal, May, 1904, *Cook & Doyle* 281 (N). Salamá, June, 1904, *Cook* 267 (N). Cubilquitz, Department of Alta Verapaz, alt. 350 meters, May, 1901, *von Türckheim* (J. D. Smith, no. 7981) (N, G); August, 1900, *von Türckheim* (J. D. Smith, no. 7774) (N, G). Cenaguilla, Department of Santa Rosa, alt. 1,300 meters, November, 1892, *Heyde & Lux* (J. D. Smith, no. 4402) (N, G). Joyabaj, May, 1906, *Cook* 21 (N). Near Guatemala City, July, 1860, *Hayes* (G). Hills along the southern shore of Lake Amatitlán, alt. 1,350 meters, April, 1905, *Pittier* 110 (N).

EL SALVADOR: Without definite locality, *Renson* 71 (N).

NICARAGUA: Without definite locality, *Wright* (N, G).

COSTA RICA: San José, alt. 1,000 meters, November, 1901, *Pittier* 16217 (N); November, 1910, *Tonduz & Jiménez* 17539 (N). San Francisco de Guadalupe, alt. 1,200 meters, August, 1897, *Tonduz* 11299 (N). Portail de la Hacienda Belmira, près Santa María de Dota, alt. 1,450 meters, January, 1898, *Tonduz* 11650 (N). San Pedro, près San Ramón, alt. 1,300 meters, April, 1913, *Tonduz* 17655 (N). Entre San Pedro et le Tremedal, près San Ramón, alt. 1,200 to 1,300 meters, April, 1913, *Tonduz* 17674 (N, F). Cartago, alt. 1,275 meters, April, 1894, *J. D. Smith* 4936 (N); October, 1887, *Cooper* (J. D. Smith, no. 5947B) (N). Aguacaliente, May, 1890, *Pittier* 2517 (N).

PANAMA: El Boquete, Chiriquí, alt. 1,000 to 1,300 meters, March, 1911, *Pittier* 2923 (N), 2889 (N).

Ficus padifolia is one of the most abundant and widely dispersed of the North American strangler figs. The young plant at first climbs the trunk of some tree, often a palm, by attaching its long, slender ropelike stems to the host plant by means of aerial roots. In time the fig develops a large trunk and crown and surrounds and kills the host tree. With age it forms a very broad crown, from the branches of which aerial roots descend and enter the ground, thus developing new trunks and forming a tree of the familiar banyan type of Asia and Africa. The trees at maturity are very handsome. The receptacles are edible.

Ficus padifolia is known by various local names: Sonora, "nacapulí" (Palmer); Colima, "camichín" (Palmer), or "comuchín" (Langlassé); Oaxaca, "palo de coco" (Liebmann); Costa Rica, "higuito" (Örsted); Tabasco, "amatillo" or "capulín grande" (Rovirosa).

As is to be expected from its wide range, this species exhibits great variation, more in fact than any other Central American species. This is indicated by the large number of synonyms cited above. With a small series of specimens it would be possible to differentiate several "species," but with the numerous collections at hand all the characters heretofore relied upon for differentiation break down. There is wide variation in leaf form and two types of leaves can be distinguished: one in which the blade is ovate, coriaceous, prominently 3-nerved at the base, with a very acute apex, becoming pale yellowish green when dry; the other with mostly lance-oblong blades, which are thinner, obscurely nerved, bright green or dark when dry, with an obtuse apex. The first form is chiefly western in its distribution and the second southern. Intermediate forms are found, however, and with the leaf characters there

are no concomitant peculiarities of pubescence or fruit. The form with broad leaves is usually quite glabrous and the other minutely puberulent on the young branches and stipules, but this is not invariably true. There seem to be no definite differences in the receptacles. Although the writer has tried every possible character as a basis of segregation, he has found nowhere any constant specific differences.

Langlassé's no. 1014 bis is noteworthy for its small receptacles, suggesting *F. prinoides* Kunth & Bouché, but the leaves are unlike those of that species. It may represent an undescribed species, but further collections are necessary to settle this point. A few of the Costa Rican specimens are notable for their oblanceolate leaf blades. Several Costa Rican collections were distributed under an unpublished name of Warburg's, but they seem to differ in no essential character from the mass of material examined.

Ficus padifolia was described from specimens having broad, thick leaf blades. The type of *F. complicata* was collected in Mexico near Guasitlan and Puente de Istla, by Bonpland. The type of *F. lancifolia* was from Tepic, Mexico. *Ficus consanguinea* was based upon plants of uncertain derivation grown at Berlin. Miquel referred to it specimens obtained by Schiede between Sepillo and Estura, Mexico. Indeed, it is not certain that it is correctly placed here in synonymy. The type of *Urostigma sapidum* was collected at Cartago, Costa Rica, by Örsted; that of *U. baccatum* at Hacienda de Santa Cruz, near Tehuantepec, Oaxaca, by Liebmann; and that of *U. turbinatum* at Guatulco, Oaxaca, by Liebmann. *Urostigma liebmannianum* was based upon material collected in Panama along the Chagres River. The type of *Urostigma sulcipes* was collected at Atlacomulco, Mexico, by Schiede and Deppe. Both *Ficus fasciculata* and *F. sonorae* were described from material collected at Guaymas, Sonora, by Palmer. It seems strange that Watson should have described both these species at the same time, for the specimens upon which they were based all look as though they might have come from the same tree.

Many of the collections listed here have been determined as *Ficus ligustrina* Kunth & Bouché.¹ That species was based upon cultivated specimens sent from Caracas by Moritz. It is probably the same as *F. prinoides* Humb. & Bonpl.,² the type of which was from Mérida, Colombia. The latter species, to which some of the Mexican and Central American specimens above listed have been referred, differs from *F. padifolia* in its small receptacles, with a plane or slightly elevated ostiole. The writer has seen the following specimens:

COLOMBIA: Santa Marta, *H. H. Smith* 2420 (N, F, G), 1458 (N, F, G), 1459 (N).

It occurs also in Trinidad, according to Warburg.³

33. *Ficus oerstediana* Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 299. 1867.

Urostigma oerstedianum Miquel in Seem. Bot. Voy. Herald 196. pl. 36. 1854.

Urostigma chiriquianum Miquel, Versl. Med. Kon. Akad. Amsterdam 13: 412. 1862.

Ficus chiriquiana Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 298. 1867.

Tree of medium size; young branches grayish or brownish, puberulent or glabrate; stipules 5 to 15 mm. long, acuminate, glabrous or minutely puberulent outside, deciduous; petioles stout, 3 to 15 mm. long, glabrous; leaf blades obovate, obovate-oblong, elliptic-oblong, or oblanceolate, 4 to 11 cm. long, 1 to 4.5 cm. wide, usually cuneately narrowed to the obtuse or acute base, very obtuse or acute at the apex, or often short-apiculate with a broad obtuse acumen, coriaceous, concolorous, glabrous, the costa coarse and prominent, the lateral veins very slender, only slightly prominent, 9 to 15 on each side, divergent at an angle of 60 to 80 degrees, arcuately anastomosing into a distinct submarginal vein, the secondary lateral veins slender and parallel to the primary ones; peduncles geminate, slender, glabrous or minutely puberulent,

¹ Ind. Sem. Hort. Berol. 16. 1846.

² Willd. Sp. Pl. 4: 1149. 1806.

³ In Urban, Symb. Antill. 3: 483. 1903.

3½ to 7 mm. long; involucre bilobate, about 3 mm. long, inconspicuous, the lobes broadly rounded, spreading or reflexed, minutely puberulent or glabrate; receptacles globose, 4 to 6 mm. in diameter, glabrous, reddish, the ostiole small, plane or slightly elevated, closed by 3 scales.

TYPE LOCALITY: Chiriquí Volcano, Panama. Type collected by Seemann.

SPECIMENS EXAMINED:

GUATEMALA: Near Izabal, alt. 750 meters, February, 1907, *Kellerman* 6486 (N).

COSTA RICA: Nuestro Amo, July, 1912, *Jiménez* 516 (N).

PANAMA: Without definite locality, *Duchassaing* (G). Around Caldera, Chiriquí, alt. 200 to 300 meters, March, 1911, *Pittier* 3346 (N). Vicinity of David, Chiriquí, alt. 30 to 80 meters, February, 1911, *Pittier* 2822 (N), 2823 (N).

COLOMBIA: Santa Marta, *H. H. Smith* 2625 (N).

The type of *Urostigma chiriquianum* also came from the mountains of Chiriquí.

Ficus oerstediana is related to *F. prinoides* Humb. & Bonpl., but is distinguished by the obovate, closely and regularly veined leaf blades.

34. *Ficus hemsleyana* Standley.

Urostigma verrucosum Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 321. 1851.

Ficus verrucosa Hemsl. Biol. Centr. Amer. Bot. 3: 148. 1883, not *F. verrucosa* Miquel, 1867.

Branches grayish or brownish, the young ones brown, glabrous or obscurely puberulent; stipules 10 to 17 mm. long, thin, deciduous, brown, glabrous or obscurely puberulent outside; petioles slender, 2 to 6 cm. long, glabrous or obscurely puberulent; leaf blades elliptic-oblong, or sometimes oblong-oval, oval, or ovate-oblong, 10 to 22 cm. long, 4 to 8 cm. wide, subcordate to rounded at the base and 3 or 5-nerved, abruptly acuminate or subcuspidate at the apex, or sometimes gradually acuminate, the acumen acute, glabrous, bright green on the upper surface, paler or brownish beneath, the lateral veins 7 to 13 on each side, divergent at an angle of about 60 degrees, arcuate or nearly straight, laxly and arcuately anastomosing near the margin; peduncles geminate, stout, half to two-thirds as long as the receptacles; involucre bilobate, about 4 mm. long, the lobes rounded; receptacles globose, about 1 cm. in diameter, green, minutely puberulent or glabrate, the ostiole slightly prominent, closed by 3 broad bracts.

TYPE LOCALITY: Nicaragua. Type collected by Ørsted.

SPECIMENS EXAMINED:

GUATEMALA: San Miguel Uspantán, Department of Quiché, March, 1892, *Heyde & Lux* (J. D. Smith, no. 2886) (N, G).

EL SALVADOR: Without definite locality, *Renson* 70 (N), 138 (N).

COSTA RICA: San José, alt. 1,160 meters, October, 1897, *Tonduz* 11576 (N); November, 1910, *Tonduz & Jiménez* 17543 (N), 17542 (N). Camino en San Francisco de Guadalupe, October, 1910, *Jiménez* 13 (N). San Francisco de Guadalupe, alt. 1,170 meters, *Jiménez* 536 (N), 986 (N). Río Virilla, October, 1912, *Herb. Nac. Costa Rica* (N).

PANAMA: Chagres, March, 1850, *Fendler* 286 (N). Around Culebra, strangling an *Attalea*, January, 1911, *Pittier* 2318 (N).

Tonduz's no. 11576 was determined by Warburg as a new species and distributed under an unpublished name.

35. *Ficus lentiginosa* Vahl, Enum. Pl. 2: 183. 1806.

Ficus populnea lentiginosa Warb. in Urban, Symb. Antill. 3: 476. 1903.

Young branches brownish, glabrous; stipules 1 to 1.5 cm. long, acuminate, brown, glabrous, deciduous; petioles slender, 2.5 to 10.5 cm. long, glabrous; leaf blades oval or ovate-oval, 7.5 to 16 cm. long, 5 to 9.5 cm. wide, broadly rounded and sometimes subemarginate at the base, 5-nerved, obtuse or rounded at the apex and usually

abruptly short-acuminate with an obtuse acumen, subcoriaceous, glabrous, concolorous, the midvein very prominent beneath, the lateral veins slender, slightly prominent, 8 to 12 on each side, divergent at an angle of 70 to 80 degrees, slightly arcuate, laxly anastomosing near the margin; peduncles geminate, glabrous, 3 to 5 mm. long; involucre deeply bilobate, 4 mm. long, the lobes broadly rounded, brown, glabrous; receptacles subglobose, 8 to 9 mm. in diameter, glabrous, the ostiole slightly depressed, closed by 3 scales.

TYPE LOCALITY: Montserrat.

SPECIMENS EXAMINED:

GUERRERO: Acapulco, 1894-95, *Palmer* 355 (N, G, F).

This species occurs in Porto Rico, Montserrat, Guadeloupe, Martinique, Dominica, St. Vincent, Barbados, and Grenada. The above description is based wholly on Mexican specimens, which it is suspected came from a cultivated tree.

36. *Ficus glydicarpa* Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 297. 1867.

Urostigma glydicarpum Miquel, Versl. Med. Kon. Akad. Amsterdam 13: 409. 1862.

Young branches brownish, glabrous or sparsely pilose; stipules about 1 cm. long, densely fulvous-sericeous outside; petioles stout, 1 to 2 cm. long, sparsely short-pilose or glabrate; leaf blades narrowly elliptic-oblong, narrowly obovate-oblong, or obovate, 7 to 18 cm. long, 4 to 7 cm. wide, rounded or subtruncate at the base and emarginate, sometimes deeply so, 5-nerved, obtuse or rounded at the apex and usually with a short broad obtuse acumen, coriaceous, glabrous, the costa and lateral veins very coarse and prominent beneath, the latter 7 to 12 on each side, divergent at an angle of about 45 degrees, nearly straight, arcuately anastomosing near the margin; peduncles geminate, 2 to 3 mm. long; involucre bilobate, small, thin, brown; receptacles globose, 1.5 to 2 cm. in diameter, glabrous or nearly so, the ostiole not prominent, closed by 3 brown scales.

TYPE LOCALITY: Hacienda de la Laguna, Veracruz. Type collected by Schiede, July, 1829.

SPECIMENS EXAMINED:

VERACRUZ: Region of Orizaba, August, 1866, *Bourgeau* 2818 (N, G).

Bourgeau's collection is the only one seen by the writer which agrees with Miquel's description. Miquel describes the largest leaf blades as being 20 cm. long and 7.5 cm. wide, dimensions which are not quite equaled by the present specimens.

37. *Ficus bonplandiana* (Liebm.) Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 298. 1867.

Ficus obtusifolia H. B. K. Nov. Gen. & Sp. 2: 49. 1817, not *F. obtusifolia* Roxb. 1814.

?*Urostigma involutum* Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 320. 1851.

Urostigma bonplandianum Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 323. 1851.

?*Ficus involuta* Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 298. 1867.

A large tree with short thick trunk and spreading crown; young branches very stout, densely leafy at the ends, sparsely puberulent; stipules triangular-oblong, acuminate, 1.5 to 3 cm. long, thin, dark brown, glabrous; petioles stout, 1 to 2 cm. long, glabrous; leaf blades obovate-oblong to broadly obovate, 11 to 21 cm. long, 5 to 9.5 cm. wide, cuneately narrowed to the base or rarely obtuse, rounded at the apex, coriaceous, concolorous, glabrous, the lateral veins prominent beneath, 6 to 8 on each side, ascending at an angle of 45 degrees, arcuate, distant and not closely parallel, obscurely anastomosing near the margin, the veinlets conspicuous, finely reticulate; peduncles geminate, 2 to 4 mm. long, very stout; involucre large, bilobate, often covering nearly half the receptacle, the lobes rounded, often split at the apex, finely and densely sericeous; receptacles globose, 1.5 to 2 cm. in diameter, densely and finely sericeous, the ostiole prominent, 3 mm. broad, the scales broad, rounded; sepals ferruginous.

TYPE LOCALITY: Near Acapulco, Guerrero. Type collected by Bonpland.

SPECIMENS EXAMINED:

SINALOA: Mazatlán, April, 1910, *Rose, Standley & Russell* 14104 (N); February 10, 1890, *Brandege* (C).

TEPIC: Near Pedro Paulo, August, 1897, *Rose* 1972 (N).

SAN LUIS POTOSÍ: Micos, December, 1891, *Pringle* 3977 (N, G, F). San Dieguito, June, 1905, *Palmer* 635 (F, C).

OAXACA: Road between Nopala and Mixistepec, alt. 240 to 1,200 meters, March, 1895, *Nelson* 2434 (N, G).

GUERRERO: Acapulco, 1894-95, *Palmer* 373 (N, G, F).

MICHOACÁN: Ostula, November, 1906, *Emrick* 101 (F).

YUCATÁN: Cozumel Island, April, 1901, *Goldman* 650 (N, F). Progreso, 1901, *Goldman* 609 (N, F).

GUATEMALA: Gualán, Department of Zacapa, alt. 122 meters, January, 1906, *Kellerman* 5019 (N). Joyabaj (El Quiché), May, 1906, *Cook* 23 (N). Escuintla, Department of Escuintla, alt. 330 meters, March, 1890, *J. D. Smith* 2011 (G).

COSTA RICA: Near Nicoya, February, 1900, *Pittier* 13835 (N).

This is one of the strangler figs. In Costa Rica the native name is given as "palo de agua;" at Acapulco it is "amate." A tree at the latter locality, photographed by Palmer, has a trunk 1.8 meters in diameter, and a crown 19 meters broad.

The species has a remarkably wide range as compared with most of our species, yet the specimens are very uniform.

The description of *Urostigma involutum* strongly suggests this species. The peduncles are very short, and the young receptacles might well be taken to be sessile, as described by Liebmann. The type was collected between Sapoá and Tortuga, Nicaragua, by Ørsted.

38. *Ficus jonesii* Standley, sp. nov.

Large tree with glabrous branches and leaves; stipules short, thin, sparsely sericeous outside; petioles slender, 3.5 to 7 cm. long; leaf blades oval-oblong to broadly ovate-oblong, very irregular in outline, 7.5 to 17.5 cm. long, 5 to 10 cm. wide, broad at the base and cordate or subcordate, 5-nerved, slightly narrowed to the broadly rounded or very obtuse apex, sometimes short-apiculate, thin, bright green, concolorous, the margins often undulate, the lateral veins rather prominent beneath, 5 to 9 on each side, distant, ascending at an angle of 50 to 60 degrees, subarcuate, laxly anastomosing near the margin, the veinlets prominent, reticulate; receptacles globose, 2.5 cm. in diameter, densely hirtellous; sepals ferruginous.

Type in the U. S. National Herbarium, no. 237888, collected at La Palma, Jalisco, Mexico, June 7, 1892, by Marcus E. Jones (no. 33). Sterile specimens of the same species were collected above Colomas, Sinaloa, July, 1897, by J. N. Rose (no. 3220).

Mr. Jones states that this is a very large tree with the general appearance of the honey locust, *Gleditsia triacanthos*. The species is well distinguished by the broad, irregular, long-petiolate, cordate or subcordate leaves. These are very irregular in outline and sometimes almost four-sided. The single receptacle of the type specimen is detached, consequently it may have been either sessile or pedunculate; probably it was pedunculate.

39. *Ficus pittieri* Standley, sp. nov.

Tree with glabrous branches and leaves; stipules short, densely white-sericeous; petioles stout, 2.5 to 4 cm. long, glabrous; leaf blades oval or oblong-oval, 16 to 21 cm. long, 7.5 to 10.5 cm. wide, rounded at the base and slightly decurrent, 5-nerved, rounded at the apex and broadly short-apiculate, deep green, concolorous, rather thin, with subundulate margins, the lateral veins 11 to 13 on each side, prominent but slender, divergent at an angle of 60 to 80 degrees, straight, rather distant, arcuately anastomosing near the margin, the veinlets inconspicuous but very finely reticulate; peduncles

geminate, about 3 mm. long and nearly as thick, glabrate; involucre bilobate, 7 mm. broad, the lobes rounded, thin, brown, spreading, glabrate; receptacles about 2 cm. in diameter, globose, green spotted with blackish purple, glabrate, the ostiole not prominent, 4 mm. broad, closed by 3 broad, rounded, dark brown scales; sepals ferruginous.

Type in the U. S. National Herbarium, no. 676759, collected around Gamboa, Canal Zone, Panama, altitude 20 to 100 meters, February 1, 1911, by H. Pittier (no. 2602).

Very similar to the type is Fendler's no. 285 from Chagres, Panama, which has blades almost exactly the same in outline but emarginate at the base. This is an important character, and consequently Fendler's collection may well represent a distinct species. It includes a single detached receptacle, much distorted by pressure. Until better fruit is obtained it seems best to refer this plant to *F. pittieri*.

Ficus pittieri resembles *F. hemsleyana*, but in the latter species the receptacles are much smaller.

40. *Ficus goldmanii* Standley, sp. nov.

Large tree with a short, very thick trunk supported by buttresses; branches gray or light brown, the young ones stout, glabrous or nearly so; stipules short, acuminate, sericeous or puberulent outside; petioles 1.8 to 3.5 mm. long, pruinose-puberulent, becoming glabrate; leaf blades oblong or elliptic-oblong, 7 to 17 cm. long, 3.5 to 7.3 cm. wide, rounded and cordate or emarginate at the 3 or 5-nerved base, the sinus closed, sometimes 3 to 4 mm. deep, slightly narrowed to an obtuse rounded apex or broadly rounded, sometimes subemarginate, thick-coriaceous, pale green, lustrous on the upper surface, slightly paler beneath, glabrous, the costa very stout and prominent beneath, the lateral veins evident but not prominent, 5 to 13 on each side, divergent at an angle of about 60 degrees, nearly straight, laxly arcuate-anastomosing near the margin, the veinlets inconspicuous; peduncles geminate, slender, 10 to 13 mm. long, minutely puberulent; involucre bilobate; receptacles globose, 2 to 2.5 cm. in diameter, spotted with light and dark green, grayish-puberulent or sparsely hirtellous with white hairs, the ostiole not prominent, 3 to 4.5 mm. broad, closed by thin, obtuse, green or brown scales; sepals pale brown.

Type in the U. S. National Herbarium, no. 335786, collected at Alamos, Sonora, Mexico, January 1, 1899, by E. A. Goldman (no. 288). There is a specimen of the same collection in the Gray Herbarium.

ADDITIONAL SPECIMENS EXAMINED:

SONORA: Arroyo at base of Sierra de Alamos, March, 1910, *Rose, Standley & Russell* 13006 (N).

SINALOA: Cofradía, October, 1904, *Brandeggee* (C).

DURANGO: Chacala, March, 1899, *Goldman* 355 (G).

JALISCO: Near Guadalajara, September, 1891, *Pringle* 3890 (N, F).

The proposed species is related to *Ficus lapathifolia*, but in that the leaf blades are larger, pubescent, and on usually shorter petioles, and the receptacles are more copiously pubescent. It is related also to *Ficus yucatanensis*, but that species differs in having the proportionally broader leaf blades scarcely or not at all emarginate at the base.

A specimen in the National Herbarium, collected between Salamá and Rabinal, Guatemala, in May, 1904, by O. F. Cook and C. B. Doyle, the writer can not distinguish from *F. goldmanii*. The material, however, is in very poor condition, the receptacles being molded and broken. The leaves are not exactly like those of *F. goldmanii*, and with better material it may be possible to distinguish it specifically. Pringle's no. 3890 was distributed as "*Ficus guadalajarana*, Wats., n. sp.," but some confusion must be involved, for the plant described under that name is a quite different species.

41. *Ficus yucatanensis* Standley, sp. nov.

Branchlets stout, 5 to 8 mm. thick, yellowish or gray, glabrous; stipules 10 to 15 mm. long, narrowly triangular, attenuate, firm, brown, minutely puberulent outside and sparsely strigose; petioles stout, 1 to 2.4 cm. long, glabrous; leaf blades oval, narrowly oval, or oval-oblong, 8 to 20 cm. long, 4.3 to 9.5 cm. wide, rounded at the base and sometimes subemarginate, 3 or 5-nerved, broadly rounded or obtuse at the apex, coriaceous or subcoriaceous, glabrous, green on the upper surface and closely punctate, beneath pale or golden brown, the costa prominent, stout, with a glandular area at the base, the lateral veins subprominent beneath but very slender, 8 to 11 on each side, distant, straight, divergent at an angle of 45 to 80 degrees, arcuately anastomosing near the margin, the veinlets inconspicuous, laxly reticulate; peduncles geminate, 1 cm. long, glabrate; involucre bilobate, 7 mm. in greatest diameter, the lobes rounded, thin, brown, glabrous; receptacles globose, 2 cm. in diameter, glabrous or nearly so, the ostiole not prominent, 2 to 4 mm. broad, closed by 3 broad brown scales; sepals dark ferruginous.

Type in the U. S. National Herbarium, no. 396917, collected at Chichen Itzá, Yucatán, Mexico, in late January or early February, 1901, by E. A. Goldman (no. 554). There is a specimen of the same collection in the herbarium of the Field Museum of Natural History. Also collected on rocks along the seashore, Cozumel, Yucatán, April, 1901, by E. A. Goldman (no. 657) (N, F).

Related to *Ficus lapathifolia*, but distinguished by the glabrous leaves and nearly or quite glabrous receptacles. The type was determined by Dr. J. M. Greenman as *Ficus trigonata* L. f.¹ The type of that species was obtained by Dalberg in Surinam, but its identification, as stated by Warburg,² is obscure, and its description does not suggest the present plant. *Ficus trigonata* has been reported from the West Indies, but Warburg refers all the material so determined to other species.

DOUBTFUL AND EXCLUDED SPECIES.

FICUS BOTRYAPIOIDES Kunth & Bouché, Ind. Sem. Hort. Berol. 15. 1846.

Urostigma botryapioides Miquel, Lond. Journ. Bot. 6: 538. 1847.

Described from cultivated plants believed to have come from Mexico. Warburg³ considers it only a form of *F. populnea* Willd., and states that its origin was probably West Indian.

FICUS CALYCVLATA Mill. Gard. Dict. ed. 8. Ficus no. 11. 1768.

This species, the first described from Mexico, it has been impossible to identify. It was based upon material sent from Veracruz by Houston and grown in England. The essential parts of Miller's description are as follows: "This rises with many shrubby stalks to the height of twelve or fourteen feet, and divides into many smaller branches, which are garnished with oval stiff leaves, which are obtuse; they are four inches long and three broad, of a light green, and stand upon very short foot-stalks, which are joined to a cup, in which the fruit sits; this is globular and the size of a middling nutmeg, of a deep yellow, when ripe, but is not eatable." The description suggests *F. cotinifolia*, except that that has a smaller receptacle than indicated. The locality Veracruz does not necessarily imply that Houston's material came from either the city or State of that name, for it was used at that time to indicate Mexico as a whole. The type, if any was preserved, is not to be found in the herbarium of the British Museum, where Miller's herbarium is deposited.

¹ Suppl. Pl. 441. 1781.

² In Urban, Symb. Antill. 3: 463. 1903.

³ In Urban, Symb. Antill. 3: 479. 1903.

FICUS FUSCESCENS (Liebm.) Miquel, Ann. Mus. Bot. Lugd. Bat. **3**: 298. 1867.

Urostigma? fuscescens Liebm. Dansk. Vid. Selsk. Skrivt. V. **2**: 329. 1851.

Young branches thickish, terete, rugose, fuscous; leaves alternate, the blades lanceolate, 13 to 15 cm. long, 4 to 5 cm. wide, acute at both ends, gradually attenuate at the base to the petiole, dark green on the upper surface (black when dry), glabrous, the costa slightly prominent, sulcate, rufous-villosulous beneath, especially on the prominent costa and veins, the margin slightly undulate; petioles pilosulous, 6 to 8 mm. long, canaliculate above; stipules convolute, rufous-villous, lanceolate, acute; receptacles not known.

TYPE LOCALITY: Colipa, Veracruz. Type collected by Liebmann.

The plant may not be a *Ficus*.

FICUS GUMMIFERA Bertol. Mem. Accad. Sci. Bologna **10**: 40. *pl.* 9. 1859.

Evidently, from the description and illustration, a species of *Castilla*. According to Mr. H. Pittier it is, apparently, the same as *Castilla guatemalensis* Pittier.¹ The species should, therefore, be known as ***Castilla gummifera*** (Bertol.) Pittier. The type came from Escuintla, Guatemala.

UROSTIGMA? NUMMULARIA Liebm. Dansk. Vid. Selsk. Skrivt. V. **2**: 330. 1851.

Founded on sterile specimens obtained at various localities in Mexico by Liebmann. It is evidently not a *Ficus*.

FICUS NYMPHAEIFOLIA L. Mant. Pl. 305. 1767.

This species was reported from southern Darién, Panama, by Seemann,² but he was not certain as to the determination. The species is to be expected in Panama, since it occurs in Colombia. It may be recognized by the broad leaf blades, 19 to 21 cm. long and 16 to 18 cm. wide, deeply cordate at the base and broadly rounded at the apex. The only material seen by the writer is H. H. Smith's no. 1455 from Santa Marta, Colombia.

FICUS PERGAMENEA Galeotti; Miquel, Ann. Mus. Bot. Lugd. Bat. **3**: 221. 1867.

Described from sterile cultivated plants. Miquel gives the origin of these, with a query, as Mexico.

FICUS PORTEANA Regel, Gartenflora **1862**: 280. 1862.

In the Index Kewensis³ the distribution of this species is given as Mexico, but this is evidently an error, for in the original description it was stated that it came from the Philippines.

UROSTIGMA? SCANDENS Liebm. Dansk. Vid. Selsk. Skrivt. V. **2**: 330. 1851.

This, a new combination at the place cited, was based on *Ficus scandens* Lam. (a true *Ficus*), and Liebmann cited specimens of his collection from Mirador, Mexico. These, according to Warburg,⁴ are really of the genus *Marcgravia*.

CULTIVATED SPECIES.

FICUS CARICA L. Sp. Pl. 1059. 1753.

The common fig is widely cultivated in Mexico and Central America, and probably has escaped from cultivation in some places, but no specimens have been seen by the writer.

FICUS CRASSINERVIA Willd. Sp. Pl. **4**: 1138. 1806.

This is a West Indian species, occurring in Porto Rico, St. Thomas, Guadeloupe, Martinique, and Santa Lucia. A specimen in the herbarium of the Field Museum of

¹ Contr. U. S. Nat. Herb. **13**: 272. *pl.* 35-39. *f.* 50, 51. 1910.

² Bot. Voy. Herald 195. 1854.

³ **2**: 962. 1893.

⁴ In Urban, Symb. Antill. **3**: 491. 1903.

Natural History, from Moria, Puebla, collected by Nicolas, seems to belong here, and probably was taken from a cultivated specimen, since no similar or closely related species is otherwise known from Mexico. It has glabrous, oval leaf blades 7.5 to 10 cm. long, and nearly sessile, globose receptacles 9 to 15 mm. in diameter.

FICUS ELASTICA Roxb. Hort. Beng. 65. 1814.

SPECIMENS EXAMINED:

COSTA RICA: Nuestro Amo, *Herb. Nac. Costa Rica* 17551 (N).

This, the common rubber plant of the florists, is a native of Asia or Malaysia. It is distinguished by its thick, closely veined, cuspidate leaf blades and elongate receptacles.

FICUS NITIDA Thunb. *Ficus* Diss. 10. 1786.

?*Ficus arbutifolia* Link, Enum. Pl. 2: 450. 1822, not *F. arbutifolia* Pers. 1807.

?*Urostigma arbutifolium* Miquel, Versl. Med. Kon. Akad. Amsterdam 13: 412. 1862.

?*Ficus polypus* Schiede; Miquel, loc. cit. as synonym.

SPECIMENS EXAMINED:

SINALOA: Mazatlán, 1910, *Rose, Standley & Russell* 14158 (N).

VERACRUZ: Pueblo Viejo, near Tampico, 1910, *Palmer* 368 (N).

MICHOACÁN: Morelia, 1909, *Arsène* 54 (F), 60 (F).

YUCATÁN: Mérida, 1900, *Rivas* 39 (F). Ticul, 1903, *C. & E. Seler* 3869 (F).

Known in Yucatán as "laurel" and "álamo extrangero."

A native of Asia, often planted in tropical America as a shade tree. It is a handsome large tree with wide-spreading, very dense crown and glossy dark green leaves. The leaf blades are broadly obovate, pointed at the apex, glabrous, finely and closely veined; the receptacles are depressed-globose, small, with a 3-lobed involucre.

The descriptions of *Ficus arbutifolia* suggest this species very strongly. Link's species was based upon plants cultivated at Berlin.

FICUS RELIGIOSA L. Sp. Pl. 1059. 1753.

SPECIMENS EXAMINED:

YUCATÁN: Mérida, 1916, *Gaumer* 23191 (F).

PANAMA: Plaza de la Catedral, Panama, 1911, *Pittier* 3399 (N).

Readily recognized by its broadly ovate-deltoid leaf blades, with a linear acumen 4 to 5 cm. long. The tree is known at Mérida as "álamo cubano." It is a native of the East Indies, but is widely grown as a shade tree elsewhere in the Tropics.

FICUS sp.

A specimen collected in the hospital grounds at Ancón, Canal Zone, Panama (*Pittier* 6523), the writer has been unable to determine. It is one of the cauliflorous species, the receptacles being borne in naked panicles. Probably it is an Asiatic plant.

THE MIDDLE AMERICAN SPECIES OF LONCHOCARPUS

By HENRY PITTIER.

INTRODUCTION.

SCOPE AND MEANS OF THE INVESTIGATION.

The genus *Lonchocarpus* is one of the best-represented groups of the Fabaceae, subfamily Dalbergieae, in the forests and on the half-denuded hills and plains of the lower altitude belt of Central America and southern Mexico. The species, however, are not generally conspicuous as an ecologic element, and their significance from the economic standpoint is very limited, facts which probably account for the slight attention paid to the genus in recent years. Notwithstanding the evident wealth of forms, only six Middle American species have been described since the last revision by Bentham in 1860.

In the present paper I have described all the Central American and Mexican species of *Lonchocarpus*, old and new, found in the Gray, New York Botanical Garden, John Donnell Smith, Field Museum of Natural History, and United States National herbaria, all of which have very obligingly been put at my disposal. In consequence of the large increase in the number of species, it has been found necessary to discard the systematic arrangement established by Bentham and make an attempt at a new classification.

In an additional chapter a West Indian and a South American species, intimately related to and often confused with the Middle American *Punctati*, have been described and discussed, as well as several other species recently collected in Colombia and Venezuela.

HISTORY AND LIMITATION OF THE GENUS.

ORIGIN AND TYPE.

The genus *Lonchocarpus* was established by Kunth and published in 1823 in the *Nova Genera et Species* of Humboldt, Bonpland, and Kunth.¹ The name, formed from *λόγχη*, lance, and *καρπός*, fruit, refers to the peculiar shape of the legume, often resembling a lance head.

In a footnote following the original description, it is stated that the following species, heretofore considered as belonging to other genera, really pertain to the new genus:

Robinia sericea Poir.

Dalbergia domingensis Turp.

Robinia violacea Beauv.

Amerimnum scandens Willd.

Dalbergia pentaphylla Poir.

Amerimnum latifolium Willd.

As will be shown hereafter the generic identity of another *Robinia violacea*, described and named by Jacquin, must be considered doubtful.¹

Two new species were described by Kunth, *Lonchocarpus punctatus*, from the shaded forests near Cumaná, Venezuela, and *L. macrophyllus*, growing at Angostura de Carare, on the banks of the Magdalena River, Colombia. The first I regard as the type species of the genus, although this place may be claimed for *L. sericeus* H. B. K. (*Robinia sericea* Poir.), heading the list of transferred species. It seems reasonable to believe that the species first considered by Kunth were those of which he was actually handling specimens, and that the relationship of the others became evident only after he was thoroughly familiarized with these.

Of the earlier species transferred to this genus by its author, *Robinia sericea* Poir., *Dalbergia domingensis* Turp., and *Amerimnum latifolium* Willd. have without much questioning taken the place assigned to them, undergoing the appropriate change of name, and are known to-day respectively as *Lonchocarpus sericeus*, *L. domingensis*, and *L. latifolius* H. B. K. *Dalbergia pentaphylla* Poir. has been found to be a synonym of *L. latifolius*, and *Amerimnum scandens* Willd. is the Venezuelan *Pterocarpus scandens* Poir. The name *violaceus* proves invalid under *Lonchocarpus* for reasons to be stated under *L. benthamianus*.¹

FUNDAMENTAL CHARACTERS.

Lonchocarpus belongs, with several large genera (*Dalbergia*, *Machaerium*, *Pterocarpus*) and a greater number of monotypic or small ones, in the division of the Papilionatae known as the subfamily Dalbergieae, the members of which are trees or, less often, shrubs, sometimes of climbing habit. One of the fundamental characters of the subfamily, by which *Lonchocarpus* can always be distinguished from *Robinia* and *Gliricidia*, provided fruit-bearing specimens are at hand, is the indehiscent legume. When there are no fruits the decision is often difficult, even to the experienced botanist. In *Lonchocarpus* the leaflets are always exstipellate, but this is supposed to be the case also with several species of *Robinia*, as well as the whole genus *Gliricidia*.

¹ Page 87 below.

There is some measure of uncertainty as to the value of the characters of the base of the staminal tube and the freedom or coalescence of the vexillar stamen in separating *Lonchocarpus* from the mentioned genera of the Galegeae. As indicated above, Kunth considered the stamens of the former as diadelphous, a view which is hardly justified by the facts. The elder de Candolle¹ has already shown that the stamens are often monadelphous, a statement which can now be generalized. The extreme basal ring of the tube is continuous up to the time when the fecundated ovary begins to swell. On the upper side of the tube, just above the basal ring, there are two openings, oval in most species, V-shaped in a few, and separated by the vexillar stamen, which thus appears to be free for a very short distance. Farther toward the anthers the tube is completely closed, all the filaments becoming free at about the same distance from the anthers. The basal openings, or "fenestrellæ," have a distinctly thickened, callous margin, and the corresponding part of the tube is more or less dilated laterally.

In the flowers of *Robinia* and *Gliricidia* also, the staminal tube is often found to be fenestrate, but the margins of the openings seem to be always thin and the adherence of the vexillar stamen above the latter less marked in *Robinia*, the tube being almost always split, and wanting in *Gliricidia*, where that stamen is entirely freed at an early stage. In *Lonchocarpus eriophyllus* Benth., the generic position of which will remain in doubt until the fruit is found, the thickening of the margins of the fenestrellæ is hardly marked, and the tube is either split or closed. But in other cases, as in *Lonchocarpus meistophyllus* Donn. Smith, which I have transferred to *Gliricidia*, the tube is thin everywhere and the vexillar stamen either completely or partly free.

In *Lonchocarpus*, as shown by de Candolle in the memoir cited, the style is usually glabrous. This is also the case in *Gliricidia*, but in *Robinia* we find it covered with stiff hairs. Considered alone, this is consequently a character of little or no value.

The number of ovules varies in *Lonchocarpus* from 1 to 9. In only 3 of the Middle American species is the ovary 8 or 9-ovulate; 36 species have from 3 to 8 ovules, and 2 others 1 or 2. These numbers are not exceeded in the other species of the genus, and this is another reason why *L. eriophyllus*, with its 11 or 12 ovules, should be held generically doubtful. There is also variation in the adherence of the wings to the keel, and of the carinal petals to each other, which is also far from being an absolute generic character, since it is found to a greater or less degree in several arborescent or shrubby genera of both the Dalbergieae and Galegeae.

¹ DC. Mém. Legum. 278. 1825.

Besides being dehiscent, the legume is always stipitate; but this detail is not often apparent in the ovary and is not restricted to the genus.

To summarize, the differential characters of the genus are never absolute when taken singly. But the following, taken all or several together, describe it with sufficient accuracy. Every one of these characters, considered separately, will be found to be shared with other more or less nearly related genera, but it is their concurrence upon which the genus *Lonchocarpus* is based.

These characters are: (1) Legume indehiscent; (2) leaflets exstipellate; (3) legume stipitate; (4) stamens monadelphous, the base of the staminal tube 2-fenestrate, the openings with callous margin; (5) ovules 1 to 9; (6) style glabrous or at most sparsely pubescent; (7) leaves alternate; leaflets opposite.

THE AMERICAN SPECIES OF DERRIS.

The characters above attributed to *Lonchocarpus* are shared by the so-called American species of *Derris*. These species differ only in a very secondary detail of the legume, viz, the greater or less development of the vexillar margin, or of both margins. I have no hesitation in bringing into the former genus the Costa Rican species of *Derris* described recently by Capt. John Donnell Smith. They fit nicely into the classification and, considering the broad range of variation in the shape of the legume within the genus, I can not but believe that respect for the authority of Bentham, which I myself share to a certain extent, is the only argument for keeping them apart. The fruits of *Derris nicoyensis*, *D. costaricensis*, and *D. peninsularis* do not differ more than does that of *Lonchocarpus neuroscapha* or *L. sericeus* from that of the typical *L. punctatus*.

As to *Derris grandifolia* I hold it to constitute in itself a well characterized genus, hardly closely related to either *Lonchocarpus* or *Derris*. This will be described in a future publication under a new generic name.

The reasons for transferring the Costa Rican species of *Derris* hold in the same manner in the case of the three South American species *D. guyanensis*, *D. negrensis*, and *D. longifolia*. Though the fact that they are described as climbing shrubs would hardly exclude them from *Lonchocarpus*, we find that in *D. guyanensis* the legume has a well-defined, narrow wing and the seeds have a characteristic shape, while the other details of the plate in the *Flora Brasiliensis*¹ remind one of some species of *Lonchocarpus*, section *Paniculati*. The two other species differ mainly in the short and broad legume.

¹ 15¹: pl. 107.

According to Bentham, the vexillar stamen is almost always detached in *Derris longifolia*, never in *D. guyanensis*.¹

GENERA ESTABLISHED WITHIN LONCHOCARPUS.

In 1837 Vogel² founded his genus *Sphinctolobium* on a plant collected by Luschnath near Rio de Janeiro. The main characters consisted in a 5-toothed calyx with the teeth sometimes obsolete and a flat-compressed legume, sometimes 1-seeded, or 2 or 3-seeded and then contracted between the seeds (whence the generic name). These characters obviously belong to *Lonchocarpus*, to which Vogel's three Brazilian species (*S. virgilioides*, *S. nitidum*, and *S. floribundum*) were transferred by Bentham. The special features given by Vogel as fundamental are not even confined to a single group, but are found in species widely apart. To this botanist, however, we owe the first mention of the fact that in *Lonchocarpus* the staminal tube is entire, that is to say, continuously closed above the fenestrellæ.

The genus *Neuroscapha*, established by Tulasne³ in 1843, had certainly a better foundation. The type is *Neuroscapha guilleminiana* (*Lonchocarpus neuroscapha*) and the genus included all the species of *Lonchocarpus* in which the legume is thickened or broadened on the parts of the vexillar margin fronting the seeds. This is a well-defined feature, but as all the other characters also belong to *Lonchocarpus*, Bentham considered *Neuroscapha* as a simple section of this genus.

In 1844 Fenzl⁴ proposed, without describing it, his African genus *Philenoptera*, the principal character of which seems to have been the elliptic-lanceolate legume with a paper-like texture. The type of *Philenoptera* was *P. kotschyana* Fenzl, described by Hochstetter⁵ as *P. schimperi* and by Bentham as *Lonchocarpus philenoptera*. The same plant is the type also of a fourth genus, *Capassa*, proposed by Klotzsch⁶ but never described.

In the classification of the Middle American species given hereafter, the name *Philenopteri* has been adopted to designate the first

¹ This name is not in accordance with the rules. The species was published in 1775 in the *Plantes de la Guiane*, under the name of *Deguelia scandens* Aubl. This has priority over *Dalbergia scandens* Roxb., used for the first time in the *Plants of Coromandel*, volume 3, issued not earlier than 1800. The Guiana plant should consequently be called ***Derris scandens*** (Aubl.), while the East Indian species would become ***Derris timorensis*** (DC.), having been described in de Candolle's *Prodromus* (2: 417. 1815) as *Dalbergia timorensis* DC.

² *Linnaea* 11: 417.

³ *Ann. Sci. Nat. II. Bot.* 20: 137. 1843.

⁴ *Flora* 27: 312. 1844.

⁵ In A. Rich. *Tent. Fl. Abyss.* 1: 232. 1847.

⁶ *Pl. Peters. Exsicc.*, under *Capassa violacea* Klotzsch.

section, the species of which have the membranous legume attributed to the genus *Philenoptera*.

GROUPING OF THE SPECIES.

BENTHAM'S CLASSIFICATION AND TAUBERT'S REARRANGEMENT.

Bentham is to this day our greatest authority on the taxonomy of the Leguminosae and we owe to him the first attempt at a general revision of *Lonchocarpus* and its division into natural groups. In his synopsis of the *Dalbergieae* ¹ he brought together 46 species under 7 heads with characters which can be stated as follows: ²

Floral peduncles geminate or bifurcate or sometimes several together, but not fasciculate.

Legume thickened at the seeds along the vexillar margin;

standard mostly silky without..... 1. NEUROSCAPHI.

Legume not thickened on the vexillar margin.

Leaflets not punctate.

Leaves softly tomentose or villous throughout..... 3. ERIOPHYLLI.

Leaves glabrous or more or less hairy, but not tomentose or villous on both sides.

Standard appendiculate and more or less callous

at the base..... 2. DENSIFLORI.

Standard attenuate and not callous at the base.. 4. LAXIFLORI.

Leaflets pellucid-punctate..... 5. PUNCTATI.

Floral peduncles neither distinctly geminate nor bifurcate.

Inflorescence a ramified terminal panicle..... 6. PANICULATI.

Inflorescence simple, the flowers fasciculate..... 7. FASCICULATI.

In the *Pflanzenfamilien* ³ Taubert has the following arrangement, which has the advantage of giving the sections according to their numerical order but is founded partly on a misstatement. The *Neuroscaphi*, *Densiflori*, and *Laxiflori*, namely, have the leaflets far from always glabrous on the upper surface. Besides this, the more or less marked pubescence or silkiness of the standard is hardly a safe character, and the distinction between the *Fasciculati* and *Paniculati* can be made clearer.

¹ Synopsis of *Dalbergieae*, a tribe of Leguminosae. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 1-128. 1860.

² In all the following descriptions I distinguish in the inflorescence the rachis, the peduncles, and the pedicels, which is not exactly in accord with the usual nomenclature, but simplifies the expression. The rachis is the peduncle proper, while what I call peduncle would be a pedicel of the first order, and my pedicels are those of the second order.

³ 33: 343. 1891.

Flowers geminate along the rachis, rarely several together and then the leaves pellucid-punctate.

Leaflets glabrous above.

Leaflets not pellucid-punctate.

Standard callous or auriculate at the base.

Standard mostly silky without; upper suture of of the legume thickened and broader at the seeds.....

1. NEUROSCAPHI.

Standard glabrous or sparsely silky without; upper suture of the legume not thickened..

2. DENSIFLORI.

Standard not callous nor auriculate at the base, perfectly glabrous without or very sparsely silky..

3. LAXIFLORI.

Leaflets pellucid-punctate; standard glabrous or sparsely silky without.....

4. PUNCTATI.

Leaflets tomentose or villous on both sides.....

5. ERIOPHYLLI.

Flowers mostly fasciculate along the rachis; leaflets not pellucid-punctate.

Flowers irregularly paniculate.....

6. PANICULATI.

Flowers in simple or scarcely ramified racemes.....

7. FASCICULATI.

His second section, Densiflori, Bentham again subdivided, according to the size and dimensions of the leaves, into Macrophylli, Acuminati, and Obtusifolii, while other subdivisions, founded on characters of the carina or of the standard, were established in section 7, Fasciculati.

In the present paper I shall not discuss the last two sections, Paniculati and Fasciculati. They are not represented among the Middle American species of Lonchocarpus, and besides this they are so well characterized that they can be considered *a priori* as natural divisions within the genus.

In the other five sections the known species were grouped by Bentham in the following manner:

1. NEUROSCAPHI:	OBTUSIFOLII—
guatemalensis.	rugosus.
sericeus.	obovatus.
neuroscapha.	3. ERIOPHYLLI:
parviflorus.	phaseolifolius.
2. DENSIFLORI:	velutinus.
MACROPHYLLI—	fendleri.
unifoliolatus.	eriophyllus.
macrocarpus.	4. LAXIFLORI:
spiniflorus.	(Formed of 6 exclusively Brazilian
ACUMINATI—	species.)
hondurensis.	5. PUNCTATI:
atropurpureus.	violaceus.
lanceolatus.	confertiflorus.
rubiginosus.	araripensis.
nitidus.	subglaucescens.

Subsequent advance in the knowledge of the genus calls for the transfer from the section Densiflori to the section Neuroscaphi of *L.*

atropurpureus and *L. lanceolatus*, and it is probable that *L. hondurensis* also belongs to the latter group. With these exceptions, Benthams species seem tolerably well grouped, but the same distinctions will hardly serve for the establishment of well-defined groups among the 40 species recognized in this paper for Central America and Mexico.

NEW CLASSIFICATION OF THE MIDDLE AMERICAN SPECIES.

To provide for these species the following attempt has been made at a more comprehensive grouping, in sections and higher units.

KEY TO THE SUBGROUPS.

- Legume narrowly lanceolate or broadly quadrate-lanceolate, the margin almost uniform in width, sharp-edged or rounded.
(Subgenus 1. *EULONCHOCARPUS*.)
- Costa and veins deeply impressed on the upper face of the leaflets, very prominent beneath; leaves more or less tomentose or villous; flowers (the standard principally) more or less silky-pubescent; legume lanceolate or elongate, 1 to 6-seeded, glabrous or ferruginous-tomentose. (Series 1. *IMPRESSINERVI*.)
- Legume membranous, not over 2 cm. broad, more or less elongate; wings narrow, more or less distinctly plicate transversely on the vexillar side..... 1. *PHILENOPTERI*.
- Legume coriaceous, ovate-lanceolate, the seeds embedded in a thick, porous tissue; wings ovate, not plicate; ovules 2 or 3..... 2. *SPONGOPTERI*.
- Costa and veins seldom deeply impressed on the upper face of the leaflets, the veins more or less prominent beneath; leaves glabrous or more or less pubescent; flowers glabrous or pubescent; legume lanceolate or quadrate-lanceolate, 1 or 2-seeded, glabrous. (Series 2. *PLANINERVI*.)
- Leaflets punctate; calyx and petals often yellow-dotted; standard bilobulate at the base..... 3. *PUNCTATI*.
- Leaflets not punctate and petals not dotted; standard elobulate, usually truncate at the base..... 4. *EPUNCTATI*.
- Legume lanceolate or elongate-linear, the vexillar margin thickened at the seeds, carinate or concave. (Subgenus 2. *NEUROSCAPHA*.)
- Petals sparsely pubescent, or the standard silky-pubescent, the flowers then very small (not over 5.5 mm. long).
- Leaves rather small; legume (as far as known) glabrous, narrow and elongate, or broader and then 1-seeded (the leaflets then small). (Series 3. *PUBIFLORI*.)
- Petals more or less silky-pubescent.
- Leaves of medium size or large; legume thick, ferruginous-pubescent or glabrescent, sometimes glabrous. (Series 4. *SERICIFLORI*.)
- Vexillar margin of the legume flat or concave..... 5. *CONCAVI*.
- Vexillar margin of the legume carinate..... 6. *CARINATI*.

While still far from absolutely satisfactory, this arrangement seems to bring the species more closely together according to their nearest

affinities. But it has also marked deficiencies. In the first place, the modification of the vexillar margin of the legume, which is fundamental to the distinction of the two subgenera, seems to be only a secondary character, not bound to any other important modification in the structure of the flowers or of the leaves, so that it is hardly possible to place a species in the right subgenus in the absence of the fruit. In a general way, however, it can be said that all species with small leaflets belong to *Neuroscapha*, and all species with pellucid-punctate leaflets are included in *Eulonchocarpus*.

The above system could easily be extended so as to include the other American species, by elevating the sections *Paniculati* and *Fasciculati* to subgeneric rank.¹ The species of the section *Laxiflori* would be included under *Eulonchocarpus*.

DISTRIBUTION OF THE SPECIES.

DISPERSION OUTSIDE OF MIDDLE AMERICA.

The genus *Lonchocarpus* is distributed over tropical America as well as tropical and austral Africa. A few species are found also in Madagascar and Australia. *Lonchocarpus sericeus* (Poir.) H. B. K. is the only species common to America and the West Coast of Africa. It seems to be also the only representative of the subgenus *Neuroscapha* reaching beyond the limits of America. *Eulonchocarpus* is entirely neotropical; all the African and Australian species but the one mentioned above belong either to the section *Paniculati* or the section *Fasciculati*, or to recently established groups.

¹ The section *Fasciculati* Benth. forms a natural group, characterized by having the flowers fasciculate on thick peduncles branching from the common rachis, by the peculiar shape of the wings, often reflexed and shrivelled at the later stages of the flowers, and by the leaflets, the costa and veins of which are neatly reticulate and very prominent beneath. These characters appear sufficient to justify the elevation of the section to the rank of a subgenus, for which the name *Phacelanthus* is here proposed.

In all species the pistil is also slender, with a moderately arcuate style, which is either glabrous (*L. nitidulus*, *L. glabrescens*) or more or less hairy. Among the species I have seen, the ovary is 2-ovulate in *L. negrensis* and *L. floribundus* and 8 to 10-ovulate in *L. spruceanus* and *L. glabrescens*. *Lonchocarpus costatus* is said to have 6 to 8 ovules, while *L. variflorus* and *L. nitidulus* are species with 2-ovulate ovaries. *Lonchocarpus boliviensis*, the fruit of which is not known, while closely related to several of the above-named species, constitutes a remarkable exception in the genus on account of its having 16 to 18 ovules. It is described for the first time in the present paper (p. 93). The Mexican tree or shrub described by Bentham as *L. eriophyllus* has only 11 or 12 ovules, but it differs from *Lonchocarpus* by several other important characters (p. 85). We have seen that in the Middle American species the maximum number of ovules is 9. In South America, besides the 2 species mentioned above, *L. denudatus* Benth., of the section *Laxiflori*, is also known to have 10 ovules, all the other species showing a smaller number.

Up to the present no representatives of the two sections just named have been reported from Central America or the West Indies. The westernmost species of the section *Paniculati* was collected in Santa Marta (Colombia) by Herbert H. Smith; it is described in this paper under the name of *L. sanctae-marthae*. The *Fasciculati*, well represented in Brazil, reach westward to Venezuela, but the section *Laxiflori* is entirely Brazilian.

Thus the great majority of the Brazilian species belong to sections not represented in Middle America, while the *Lonchocarpus* flora of the latter area is made up exclusively of representatives of *Neuroscapha* and *Eulonchocarpus*, which have only a small representation in South America.

Of the 40 species included in the analytical key, only 4 extend beyond the limits of Middle America. They are *Lonchocarpus velutinus*, originally described from Panama, but apparently common in Santa Marta (Colombia) and undoubtedly in the foothills of the intervening region; *L. latifolius*, reported from Colombia and Surinam, and especially common all over the West Indies; *L. atropurpureus*, an exclusively continental species like *L. velutinus*, specimens of which have been collected all over the northern parts of South America from Ecuador to Venezuela, in the lower mountain belt; and finally *L. sericeus*, already cited as extending to western Africa, and distributed in America from Mexico to Brazil and in the West Indies.

DISTRIBUTION IN MIDDLE AMERICA.

Most of the Middle American species have only a limited (areal) range, only four species, as shown above, extending beyond the limits of that region of the Western Continent. Here, the northernmost limit of the whole genus is about $21^{\circ} 30'$ north latitude and it is reached, so far as is known, only by one species, *L. megalanthus*.

In Mexico a few species reach the central xerophytic plateau or its borders. Thus *oaxacensis* and *unifoliolatus* probably reach the former in the States of Oaxaca and Puebla, while *rugosus*, *jalisicensis*, *caudatus*, and *emarginatus* are found in the mountains which fringe the plateau on its southwest side and can be considered also as belonging to the tropical province of Middle America. The xerophytic districts in central Guatemala and the interior valleys of Costa Rica, considered by Engler and his followers as parts of the Andine floral system, have not so far furnished any contribution to *Lonchocarpus*, but in Yucatán we find at least three species, *rugosus*, *longistylus*, and *yucatanensis*, the first with a wider dispersion, the two latter apparently locally endemic.

The neotropical floral province, including both coasts of Middle America from about the twenty-first degree of northern latitude southward, and including almost the whole territory of Panama, claims four-fifths, or 32, of the reported species of the genus. Of these, 22 belong exclu-

sively to the semiarid Pacific coast, which can consequently be considered the main endemic center. Of the species reported from the Pacific slopes and coast, 13 belong to the subgenus *Eulonchocarpus* and 9 to *Neuroscapha*. Of the former, all the species of the section *Spongopteri* seem to have originated along this coast, 3 of them (*peninsularis*, *nicoyensis*, and *costaricensis*) being apparently localized in the peninsula of Nicoya and its immediate surroundings, and 2 (*eriocarinalis* and *jaliscensis*) in the tierra caliente of western Mexico.

Even making due allowance for our imperfect knowledge of the distribution of the several species, it can be definitely stated that most of them have very limited areas of dispersion, even within Middle America. Excluding *velutinus*, *latifolius*, *atropurpureus*, and *sericeus*, which we have found already to extend beyond our limits, we find that only one of the 36 remaining species is found on both sides of the isthmus of Tehuantepec, which, in the geographic and floristic sense, separates Mexico from Central America. This is *guatemalensis*, which extends along the Pacific coast from southern Mexico to Costa Rica, and reaches also the Atlantic watershed in the semiarid districts of western Guatemala. Our knowledge of the distribution of the other species is mostly limited to the type locality, which points either to an extreme splitting of species, which I refuse to admit, or to a remarkable localization of type. The latter hypothesis is corroborated by the localism of other well known species of the West Indies, as for instance, *benthamianus*, restricted to the Leeward Islands.

Distribution of the Middle American species of *Lonchocarpus*.

Species arranged by groups.	Xero- phytic province.		Neotropical province.				West Indies.	Northern South America.	Western South America.	West Africa.
			Mexico.		Central America.					
	Mexico.	Yucatán.	Atlantic.	Pacific.	Atlantic.	Pacific.				
EULONCHOCARPUS.										
1. <i>Philenopteri.</i>										
1. <i>rugosus</i>	×	×	×	×
2. <i>velutinus</i>	×	×	×
3. <i>affinis</i>	×
2. <i>Spongopteri.</i>										
4. <i>peninsularis</i>	×
5. <i>nicoyensis</i>	×
6. <i>costaricensis</i>	×
7. <i>eriocarinalis</i>	×
8. <i>jaliscensis</i>	×	×
3. <i>Punctati.</i>										
9. <i>longipedicellatus</i>	×
10. <i>melichianus</i>	×
11. <i>longistylus</i>	×
12. <i>chiricanus</i>	×
13. <i>p roteranthus</i>	×

Distribution of the Middle American species of *Lonchocarpus*—Continued.

Species arranged by groups.	Xero- phytic province.		Neotropical province.				West Indies.	Northern South America.	Western South America.	West Africa.
			Mexico.		Central America.					
	Mexico.	Yucatán.	Atlantic.	Pacific.	Atlantic.	Pacific.				
EULONCHOCARPUS—Continued.										
4. Epunctati.										
14. luteomaculatus					×					
15. purpureus						×				
16. oaxacensis	×									
17. lineatus					×					
18. unifoliolatus	×									
19. cochleatus				×						
20. caudatus	×									
21. latifolius					×	×	×	×		
22. darienensis						×				
23. megalanthus				×						
24. mexicanus			×							
NEUROSCAPHA.										
PUBIFLORI.										
25. minimiflorus.....						×				
26. atropurpureus				×	×			×	×	
27. lanceolatus				×						
28. yucatanensis.....		×								
29. orotinus.....						×				
SERICIFLORI.										
5. Concavi.										
30. hondurensis.....					×					
31. comitensis.....						×				
32. lucidus					×	×				
33. constrictus.....				×						
6. Carinati.										
34. guatemalensis.....				×	×	×				
35. emarginatus				×						
36. salvadorensis						×				
37. palmeri.....				×						
38. sericeus				×			×			×
39. robustus				×						
40. santarosanus.....						×				
RÉSUMÉ.										
EULONCHOCARPUS:										
1. Philenopteri.....		1	1	1	2	2		1		
2. Spongopteri.....	1			2		3				
3. Punctati.....		1				4				
4. Epunctati.....	3		1	2	3	3	1	1		
NEUROSCAPHA.										
Pubiflora.....		1		2	1	2		1	1	
Sericiflora:										
5. Concavi.....				1	2	2				
6. Carinati.....				5	1	3	1			1
Total.....	4	3	2	13	9	19	2	3	1	1

HABIT AND ECOLOGY OF THE MIDDLE AMERICAN SPECIES.

It is unfortunately almost the rule among collectors to limit themselves to sampling, omitting the indispensable complementary notes, or, if such notes have been made, they do not appear on the sheets, so that the botanist who later studies the specimens is at a loss as to the definition of the habit of the plant. This is generally the case with reference to the material of *Lonchocarpus*. We know, however, that the Middle American species are trees or rarely erect shrubs, some of the first reaching almost portly dimensions. *Lonchocarpus latifolius* and *L. salvadorensis* are described as large trees; *L. proteranthus* and *L. lucidus* are known to reach a height of 20 meters and over, the trunk having a diameter of 35 to 40 cm. at the base. The tree of *L. costaricensis* from which I took my specimens was low, with a rounded crown, but the diameter of the trunk was certainly not under 50 cm. A considerable number of species are indicated as reaching a height of from 8 to 10 meters, and the number of those of which it is definitely stated that they are mere shrubs is rather reduced, the mention being mostly "shrub or small tree."

It is very probable that the great majority of the species, inhabiting as they do xerophytic or semiarid areas, are deciduous. We know this positively with reference to *costaricensis*, *chiricanus*, *megalanthus*, *guatemalensis*, and *salvadorensis*, and there are inferences of the same fact for several other species. On the other hand, *L. lucidus*, as seen by myself in the Canal Zone and in the forests along the San Blas Coast, seems to be an evergreen, and such is probably the case with all species growing in districts with permanent rainfall.

Of the larger species, some grow in the open or parklike formation, as for instance *salvadorensis* and sometimes *costaricensis*, while others are found either in the lightly wooded forests of the Pacific seaboard (*proteranthus*, *orotinus*, *peninsularis*) or in the high silva of the Atlantic slope (*luteomaculatus*, *lucidus*, *hondurensis*). None of them are gregarious, and in the last-mentioned region they grow mostly on rich alluvial bottoms. In the Gatún Valley (Panama) in 1914 the tops of many trees of *L. lucidus* were surging in the middle of the newly formed lake, most of them being still in full vegetation, but apparently powerless to develop their flower buds.

The smaller species are fond of the rocky, half-denuded slopes of the lower hills, or of stony flats and sea beaches. This is principally the case with the shrubby species growing along the Pacific coast.

As to vertical distribution, most species seem to be restricted to the lower belt, this extending from sea level to 1,000 or 1,200 meters and corresponding more or less to the so-called "tierra caliente."

USES AND COMMON NAMES.

Most of the arboreous Middle American species of *Lonchocarpus* have a hard, fine-grained wood, and this could be put to many uses, but the trees grow very much scattered, and therefore the supply is small. Many of the species have hardly attracted the attention of the natives. Vernacular names have been reported for the following:

Lonchocarpus costaricensis. Siete-cueros. Nicoya, Costa Rica.

eriocarinalis. Palo de oro. Guerrero, Mexico.

hondurensis. Gusano. Tabasco, Mexico.

longistylus. Bal-ché, xbal-ché. Maya; Yucatán, Mexico.

nicoyensis. Chaperno. Nicoya, Costa Rica.

peninsularis. Chaperno. Nicoya, Costa Rica.

rugosus. Masicaarón. Honduras.

salvadorensis. Sangre de chucho; i-kua-pelo. Nahuizalco, El Salvador, the latter name in the corrupted Nahuatl dialect.

sericeus. Cocorocho. Santa Rosa, Guatemala.

velutinus. Gallote. Chiriquí, Panama.

DESCRIPTIONS.

GENUS, WITH KEY TO SPECIES.

LONCHOCARPUS H. B. K.

Calyx mostly cupulate, truncate or toothed. Standard usually suborbicular, sometimes ovate, attenuate, auriculate, or callous-plicate at the base, rounded and emarginate at the apex; wings oblique-oblong to falcate, adhering to the keel above the claw; carinal petals obtuse, more or less falcate, cohering by the carinal margin. Stamens monadelphous, the staminal tube fenestrate at the base, entirely closed in the middle, the fenestrellæ parted by the free base of the vexillar stamen. Ovary sessile or stipitate, 2 to 9-ovulate; style slender, arcuate or geniculate, the stigma usually capitellate and small. Legume broadly ovate to narrowly elongate, membranous or coriaceous, the vexillar suture thin, thickened, or slightly winged; seeds 1 to 4 or seldom more, flat-compressed, reniform and more or less orbicular.

Trees or shrubs, with imparipinnate, alternate leaves; leaflets opposite, stipellate. Stipules rudimentary or caducous. Flowers white, pink, or purple, solitary, geminate, or on a bifurcate peduncle, or else fasciculate. Inflorescence racemose, simple or ramified. Bracts and bractlets small, orbicular, ovate, or linear, early deciduous.

Genus extending over tropical America, tropical and austral Africa, Madagascar, and Australia, the Middle American species about 40.

KEY TO THE MIDDLE AMERICAN SPECIES.¹

Subgenus 1. EULONCHOCARPUS.

Series 1. IMPRESSINERVI.

Section 1. PHILENOPTERI.

Ovules 7 or 8; legume 1 to 6-seeded, ferruginous-pubescent; leaflets pilosulous or glabrescent; inflorescence distinctly paniculate. Petals deep pink.

1. *L. rugosus*.

Ovules 2 to 4; legume 1 or 2-seeded, glabrous; leaflets pubescent; inflorescences axillary.

Leaves 7-foliolate; calyx and petals deep purple, the former grayish-pubescent without..... 2. *L. velutinus*.

Leaves 13 or 15-foliolate; calyx ferruginous-tomentose without..... 3. *L. affinis*.

¹ Two species from outside of Middle America are included without number for the purpose of comparison.

Section 2. SPONGOPTERI.

Legume recurved on the carinal margin; leaflets usually 5, not reticulate, minutely cano-pubescent on the lower face..... 4. *L. peninsularis*.

Legume flat; leaflets more or less tomentose or (in *L. nicoyensis*) minutely grayish-pubescent.

Vexillar margin of the legume manifestly broadened; leaflets usually 5, broadly ovate and obtusely acuminate, minutely pubescent beneath.

5. *L. nicoyensis*.

Vexillar margin of the legume thin and narrow; leaflets ovate, rounded or emarginate at the apex, more or less tomentose.

Leaves 5 or 7-foliolate, the leaflets broadly ovate, up to 12 cm. long; bractlets long, linear; calyx ferruginous-tomentose.

6. *L. costaricensis*.

Leaves 7 to 13-foliolate, the leaflets ovate or oblong; bracts and bractlets ovate, very small; calyx pubescent.

Legume broadly ovate-lanceolate, 1 to 3-seeded, 7 to 11.5 cm. long; leaflets (7 to 11) ovate, 3 to 6.5 cm. long, 2 to 4 cm. broad, the veins deeply immersed..... 7. *L. eriocarinalis*.

Legume ovate, 1-seeded, about 4 cm. long; leaflets (7 to 13) oblong, 2 to 4.5 cm. long, 1.5 to 2.5 cm. broad, the veins not deeply immersed..... 8. *L. jaliscensis*.

Series 2. PLANINERVI.

Section 1. PUNCTATI.

Leaves, inflorescences, and young branchlets more or less pubescent.

Peduncles of the flowers about 13 mm. long, the pedicels half as long; bractlets distant from the calyx; claw of the standard 1.5 mm. long.

9. *L. longipedicellatus*.

Peduncles of the flowers 4 to 5 mm. long, the pedicels 6 to 7 mm.; bractlets close to the calyx; claw of the standard 3 to 3.5 mm. long.. 10. *L. michelianus*.

Leaves, inflorescences, and branchlets glabrous.

Leaflets 11 to 15. Petals punctate; ovules 7 or 8..... 11. *L. longistylus*.

Leaflets 5 to 11.

Legume quadrate-lanceolate, 1-seeded, about 10 cm. long and 4 cm. broad; leaflets ovate or obovate, up to 11 cm. long..... 12. *L. chiricanus*.

Legume smaller, lanceolate; leaflets smaller.

Petals densely spotted; ovules 7 to 9. (Venezuelan.)... *L. punctatus*.

Petals not spotted; ovules 3 to 5.

Legume long-stipitate, 1-seeded; leaflets membranous; basal lobules of the standard long and rounded; ovules 3 or 4. (West Indian.)..... *L. benthamianus*.

Legume short-stipitate, 1 or 2-seeded, the seeds far apart; leaflets coriaceous; basal lobules of the standard much reduced; ovules 5..... 13. *L. proteranthus*.

Section 2. EPUNCTATI.

Leaves more or less pubescent.

Ovules 2 or 4; leaflets strongly reticulate beneath. Petals purple, densely ferruginous-pubescent without.

Ovules 2; standard 11 to 11.5 mm. long, with a large yellow spot at the base, the other petals unicolored..... 14. *L. luteomaculatus*.

Ovules 4; standard 8.5 mm. long, unicolored, the other petals minutely yellow-spotted..... 15. *L. purpureus*.

Ovules 7 or 8; leaflets scarcely reticulate beneath. Standard not yellow-spotted.

Leaflets 7, ovate, obtuse; petals purplish, shading to white at the base; standard 13 mm. long..... 16. *L. oaxacensis*.

Leaflets 1 to 5, oblong, acutely acuminate; petals pink, lineolate; standard 11 mm. long..... 17. *L. lineatus*.

Leaves glabrous.

Leaves 1-foliolate. Standard ovate-oblong..... 18. *L. unifoliolatus*.

Leaves plurifoliolate.

Legume cochleate, 1 to 3-seeded, the stipe and margins dark-colored. Leaflets 5 to 9..... 19. *L. cochleatus*.

Legume flat.

Leaflets 5 or fewer, long and acutely attenuate-acuminate; legume 1 or 2-seeded..... 20. *L. caudatus*.

Leaflets 5 or more, obtuse or shortly and obtusely acuminate; ovary 4 to 6-ovulate.

Flowers small or medium-sized, the standard not over 13 mm. long.

Large tree; flowers small, greenish purple, the standard not over 7.5 mm. long; legume thin, membranous, 1 or 2-seeded; terminal leaflet up to 23 cm. long.

21. *L. latifolius*.

Shrub; flowers medium-sized or large, lavender, minutely yellow-spotted, the standard up to 13 mm. long; leaflets not over 12 mm. long..... 22. *L. darienensis*.

Flowers largest in the genus, white and purple, the standard 15 to 18.5 mm. long.

Calyx minutely darkish-pubescent; leaflets subacute at the base, the petiolules 10 mm. long, the blades oblong, up to 9 cm. long..... 23. *L. megalanthus*.

Calyx densely silvery-pubescent; leaflets broadly rounded at the base, the petiolules 7 mm. long or less, the blades ovate, up to 11 cm. long..... 24. *L. mexicanus*.

Subgenus 2. NEUROSCAPHA.

Series 2. PUBIFLORI.

Standard silky-pubescent, up to 5.5 mm. long, the wings and keel glabrous; carinal petals auriculate. Leaves 7 to 13-foliolate..... 25. *L. minimiflorus*.

Standard and petals slightly pubescent; carinal petals not auriculate.

Leaves entirely glabrous, 5 to 9-foliolate. Legume slender-stipitate, up to 10 cm. long and 1 cm. broad, flat, glabrous..... 26. *L. atropurpureus*.

Leaves more or less pubescent.

Leaves 9 to 15-foliolate. Base of calyx, wings, and carinal petals sparsely yellow-dotted; legume cochleate, thin, glabrous, up to 3.5 cm. long and 0.9 cm. broad..... 27. *L. lanceolatus*.

Leaves 5 or 7-foliolate.

Calyx densely gray-pubescent; petiolules broadly canaliculate; leaflets broadly obtuse-acuminate, usually 5, opaque.

28. *L. yucatanensis*.

Calyx ferruginous-pubescent; petiolules narrowly canaliculate; leaflets mostly 7, acute at the apex, punctate..... 29. *L. orotinus*.

Series 4. SERICIFLORI.

Section 1. CONCAVI.

Leaves entirely glabrous, 5-foliolate. Free part of the filaments minutely hairy.

30. *L. hondurensis*.

Leaves more or less pilose, pubescent, or tomentose.

Calyx fulvous-hairy; leaves 7 to 11-foliolate, the leaflets ovate, not over 4 cm. long..... 31. *L. comitensis*.

Calyx minutely pubescent; leaflets much larger.

Rachis of the leaves thick, deeply and broadly canaliculate; leaflets ovate-elliptic or obovate, obtusely acuminate; standard ovate, longer than broad; vexillar margin of the legume scarcely contracted between the seeds..... 32. *L. lucidus*.

Rachis of the leaves slender, narrowly canaliculate; leaflets obovate, obtuse or emarginate at the apex; standard orbicular, broader than long; vexillar margin of the legume strongly contracted between the seeds..... 33. *L. constrictus*.

Section 2. CARINATI.

Leaves sparsely punctate; petals densely and minutely yellow-spotted.

34. *L. guatemalensis*.

Leaves epunctate; petals not spotted.

Calyx and back of standard densely silvery-pubescent; leaflets oblong, retuse; floral racemes numerous, approximate, densely flowered.

35. *L. emarginatus*.

Calyx and standard silky but not silvery-pubescent; leaflets acuminate; floral racemes few, rather distant.

Flowers large, the standard 16 to 18 mm. long; bractlets relatively large, ovate or suborbicular, 2 to 3 mm. long and broad.

Leaves 7-foliolate, the rachis subterete; leaflets subacute-acuminate; calyx truncate; basal lobules of the standard obsolete and inflexed..... 36. *L. salvadorensis*.

Leaves 7 to 13-foliolate, the rachis canaliculate; leaflets obtusely acuminate; calyx sinuate-dentate; basal lobules of the standard acute, remote from the claw..... 37. *L. palmeri*.

Flowers smaller, the standard less than 15 mm. long; bractlets oblong, very small.

Carinal petals oblong, 13 mm. long and 3.5 mm. broad; leaflets obtuse.

Peduncles and pedicels about 3 mm. long..... 38. *L. sericeus*.

Carinal petals subrhomboidal, the blade short and broad; leaflets acuminate.

Peduncles and pedicels about 1 mm. long; carinal petals 7.5 mm. long, 3.5 mm. broad; leaflets obtusely acuminate.

39. *L. robustus*.

Peduncles 4 to 6 mm., the pedicels 2 to 3 mm. long; carinal petals 5.5 mm. long, 2.5 mm. broad; leaflets acutely acuminate.

40. *L. santarosanus*.

MIDDLE AMERICAN SPECIES.

1. *Lonchocarpus rugosus* Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 92. 1860. PLATE 1, A. FIGURE 1.

A tree, the branchlets stout, nodose, gray, lenticellate, the younger parts tomentellous.

Leaves 9 to 17-foliolate, the rachis fulvescent-tomentose, terete, 10 to 20 cm. long. Leaflets coriaceous, the petiolules terete, tomentose, 2 to 3 mm. long, the blades ovate to oblong, rounded at the base, rounded-obtuse at the apex, 2.5 to 6.5 cm. long, 0.9 to 2.5 cm. broad, pilosulous or glabrescent, the costa and veins deeply immersed above, beneath pubescent-tomentose, reticulate, the costa and veins ferruginous-pubescent and prominent. Stipules acutely triangular, about 4 mm. long, hairy, caducous.

Racemes numerous, paniculate at the ends of the branchlets, 6 to 8 cm. long, the rachis tomentose; bracts at the insertion of the racemes triangular-acute, pubescent, about 2 mm. long, caducous. Peduncles and pedicels densely



FIG. 1.—*Lonchocarpus rugosus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Rose, Painter & Rose 9380.

ferruginous or fulvous-pubescent, the former very short or wanting, the latter 2 to 4 mm. long; bractlets at the base and near the apex of the pedicel very small, orbicular, fulvous-pubescent, caducous. Calyx campanulate, subacute at the base, distinctly 5-toothed, densely fulvous-pubescent, the carinal tooth longer, the 2 vexillar teeth connate into a rounded lobe. Petals deep pink; standard suborbicular (broader than long), subbilobulate and plicate at the base, more or less emarginate at the apex, densely fulvous-pubescent without, the claw about 1 mm. long, the blade 6 mm. long, 8 mm. broad; wings oblique, oblong, narrow, auriculate, glabrous but for a few hairs at the base of the blade on the carinal margin, the claw about 2.5 mm. long, the blade plicate on the vexillar side, about 6.5 mm. long and 2.2 mm. broad; carinal petals falcate, auriculate, obtuse, densely fulvous-pubescent along the carinal margin and at the apex, the claw

about 2 mm. long, the blade 5.5 mm. long and about 2.8 mm. broad. Vexillar stamen free at the base. Ovary linear, sessile, densely cano-pubescent, about 5 mm. long, 7 or 8-ovulate; style arcuate, glabrous; stigma capitellate.

Legume elongate, narrow, attenuate, and short-stipitate at the base, obtuse or rounded and mucronulate at the apex, more or less furfuraceous, 1 to 6-seeded, 4 to 14 cm. long, 1.7 to 2 cm. broad; mature seeds not seen.

Type collected in Campeche, Mexico, by Houstoun.

SPECIMENS EXAMINED:

MEXICO: Near Iguala, Guerrero, flowers, August 11, 1905, *Rose* 9380; young fruits, *Pringle* 10338. Izamal, Yucatán, flowers, 1895, *Gaumer* 996.

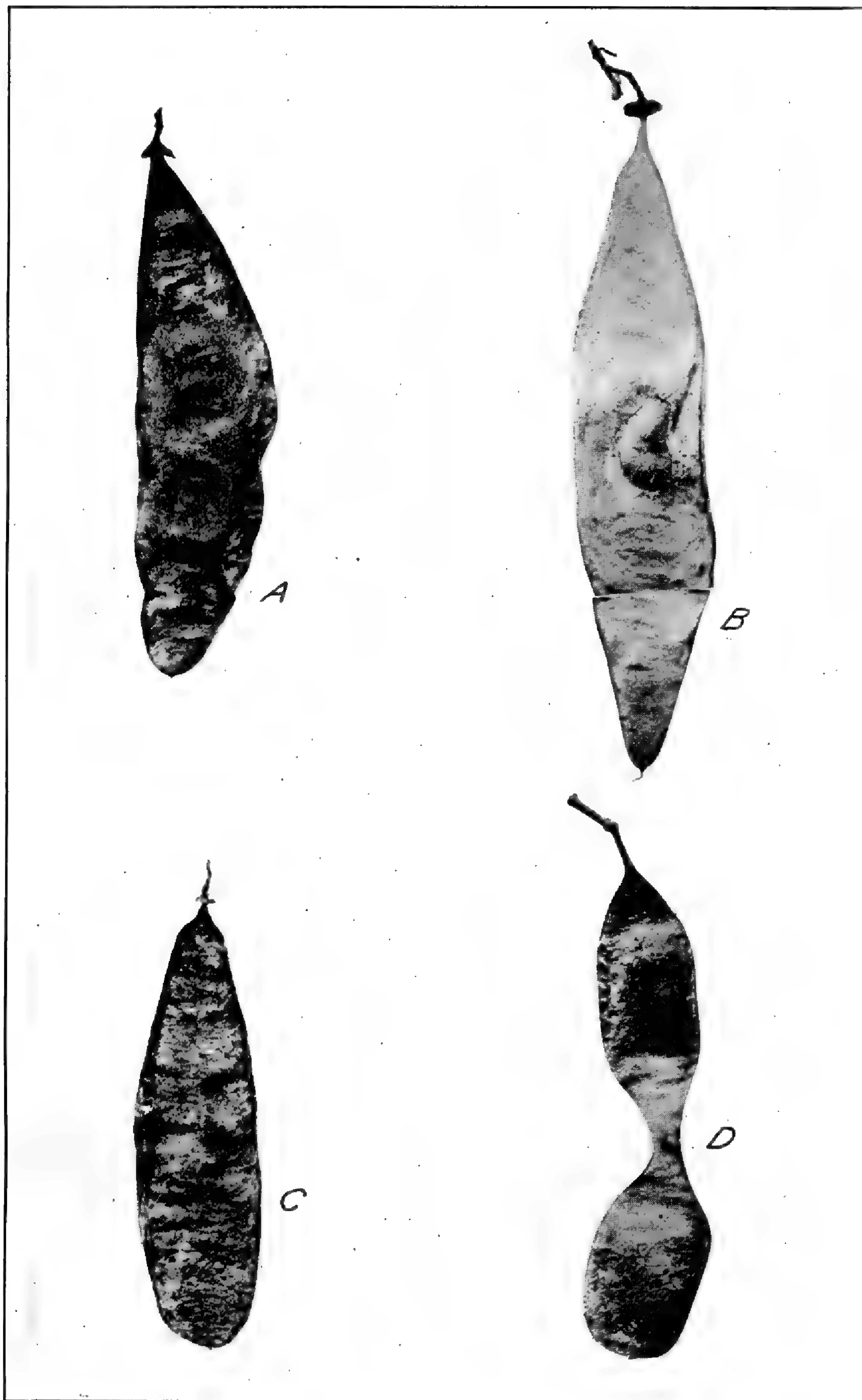
BRITISH HONDURAS: Near Toledo, in forest, young fruits, January 15, 1907, *Peck* 600.

GUATEMALA: Near Santa Rosa, Department of Santa Rosa, alt. 1,000 meters, flowers and young fruits, July, 1892, *Heyde & Lux* (J. D. Smith, no. 3281).

HONDURAS: Between El Chaparral and Meambar, road from Comayagua to Puerto Cortés, February 24, 1898, *Niederlein* (vernacular name "masicaarón").

These specimens differ from the original description in the larger number of leaflets and their very variable size. The inflorescence is a typical aphyllous panicle, like that of *L. subglaucescens* Mart., notwithstanding which neither of these two species belongs to the section *Paniculati*.

EXPLANATION OF PLATE 1.—Fruits of 4 species of *Lonchocarpus*. Fig. A, *L. rugosus*, from *Peck* 600; fig. B, *L. velutinus*, from *H. H. Smith* 934; fig. C, *L. affinis*, from *Bourgeau* 2834; fig. D, *L. sanctae-marthae* (p. 92 below), from type collection, *H. H. Smith* 107. Natural size.



FRUITS OF (A) *Lonchocarpus rugosus* Benth., (B) *L. velutinus* Benth., (C) *L. affinis* Pittier, and (D) *L. sanctae-marthae* Pittier.

2. *Lonchocarpus velutinus* Benth. in Seem. Bot. Voy. Herald 111. 1853.

PLATE 1, B. FIGURE 2.

A tree 5 to 16 meters high, the branchlets grayish or brownish, lenticellate, the young shoots finely pubescent.

Leaves 7-foliolate, the rachis narrowly canaliculate, densely pubescent, 8 to 18 cm. long. Leaflets subcoriaceous, the petiolules dark-colored, fuliginous-pubescent, about 6 mm. long, the blades ovate, obovate, or oblong, subacute to acute-attenuate at the base, usually shortly acute-acuminate, but sometimes acute, obtuse, or retuse at the apex, 5 to 14 cm. long, 2 to 5.5 cm. broad, densely felted-pubescent, the costa and veins impressed above, reticulate, grayish-pubescent, the venation prominent beneath. Stipules linear, hairy, very small, caducous.

Racemes simple, axillary, often subpaniculate at the ends of the branchlets, the rachis brown or grayish velvety pubescent, 12 to 20 cm. long. Peduncles and pedicels minutely hairy, the former usually biflorous, 2 to 4 mm. long, the latter 2 to 3 mm. long; bracts and bractlets linear, very small, hairy, caducous, the latter distant from the base of the calyx. Flowers entirely deep purple. Calyx salverform, broad, about 2.5 mm. long, finely pubescent without, 5-toothed, the two vexillar teeth broadly rounded and coalescent, the lateral and carinal ones acute, the latter longer. Standard suborbicular, concave, slightly attenuate and callous-plicate at the base, emarginate at the apex, minutely silky-pubescent without, the claw about 2 mm. long and obliquely inserted, the blade 7 mm. long, 8.5 to 9 mm. broad, the margins revolute; wings narrowly oblong, plicate on the upper margin, slightly pubescent at the apex without, the claw about 2.5 mm. long, the blade 5.5 mm. long and 2 mm. broad; carinal petals falcate, obtuse, pubescent without along the dorsal line, the claw as in the wings, the blades about 5 mm. long, 2.5 to 3 mm. broad. Vexillar stamen free at the base, the staminal tube and filaments glabrous, the anthers ovoid, sparsely and minutely hairy. Ovary linear, sessile, about 7.5 mm. long, 1 or 2-ovulate, densely pubescent; style sharply incurved; stigma capitellate, exceeding the stamens.

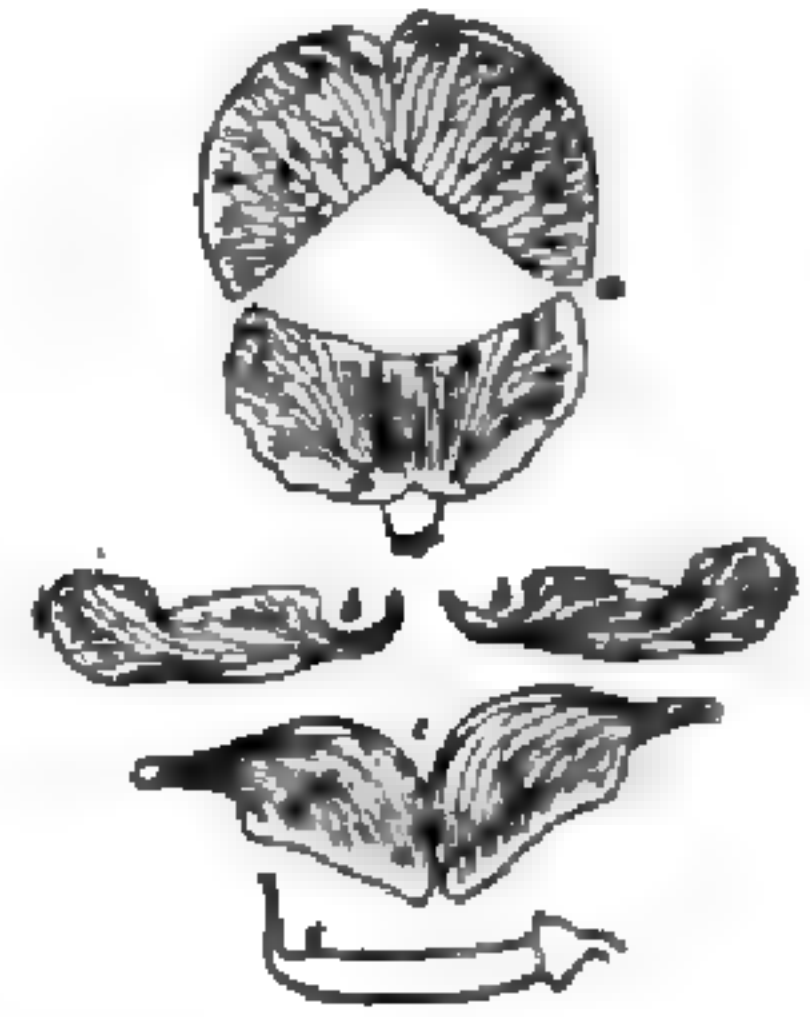


FIG. 2. — *Lonchocarpus velutinus*.
a, Standard; b, wings; c, carinal petals; e, pistil. Natural size. From R. S. Williams 349.

Legume elongate-lanceolate, attenuate and short-stipitate at the base, rounded and apiculate at the apex, 1 or 2-seeded, 8.5 to 11 cm. long, about 1.7 cm. broad, thin and submembranous, pale yellow, pubescent or glabrescent, the vexillar margin slightly thickened, the carinal margin thin-edged. Seeds crescent-shaped, flat, pale brown, about 12 mm. long and 4 mm. broad.

Type from Panama, collected at Culebra, Canal Zone, by Hinds.

SPECIMENS EXAMINED:

PANAMA: San Carlos, Province of Panama, *Seemann* 1183 (cited in original description). Vicinity of Penonomé, Province of Coclé, in flower, March, 1908, *Williams* 349. Caldera, Chiriquí, in flower, March 22, 1911, *Pittier* 3353.

COLOMBIA: Near Masinga, and on Aguadulce road near Santa Marta, in flower and fruit, January 6 and April 25, 1899, *H. H. Smith* 930, 934. Forest along a stream on the road from Bonda to Don Amo, Cordillera de Santa Marta, alt. about 170 meters, in flower, February 8, 1899, *H. H. Smith* 933. Forest beyond Don Amo, on the mountain trail to Cordillera de Santa Marta, alt. about 700 meters, in flower, March 12, 1899, *H. H. Smith* 2028, 2029.

The leaflets are variable in shape and size, but on 15 sheets examined the leaves were invariably 7-foliolate. The color of the flowers varies from deep purple or crimson to yellowish and dull purple. The tree seems to be of frequent occurrence in the lower belt of the Cordillera de Santa Marta and was also noted as common on the road from Caldera to David, in the Province of Chiriquí.

The specimens from Santa Marta were distributed as *Lonchocarpus latifolius* (Willd.) H. B. K.

3. *Lonchocarpus affinis* Pittier, sp. nov.

PLATE 1, C. FIGURE 3.

A tree, the branchlets thick, nodose, the younger parts ferruginous-pubescent.

Leaves 13 or 15-foliolate, rarely 11-foliolate, the rachis subterete, 19 to 27 cm. long, at first ferruginous-hairy, later glabrescent. Leaflets coriaceous, the petiolules 5 to 6 mm. long, subcanaliculate, ferruginous-hairy, the blades oblong, rounded and sub-attenuate at the base, obtuse, acute, or shortly subacuminate at the apex, 3 to 12.5 cm. long, 1.8 to 4 cm. broad, glabrous and impressed-reticulate above, elevated-reticulate and softly pubescent beneath, the costa and veins ferruginous-pubescent and impressed above, ferruginous-hairy and very prominent beneath. Stipules ovate, ferruginous-hairy, caducous.

Racemes axillary, mostly paniculate at the ends of the branchlets, the rachis terete, 10 to 13 cm. long, ferruginous-hairy. Peduncles and pedicels ferruginous-hairy, the

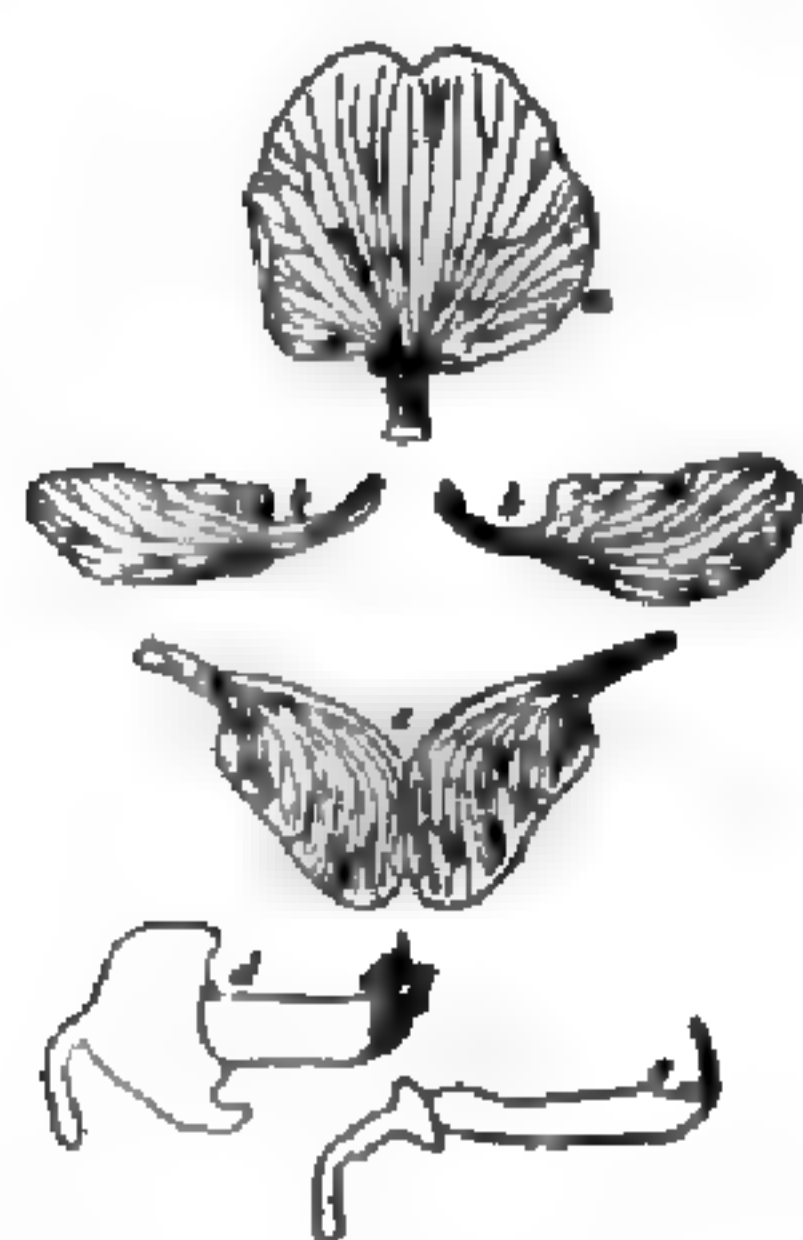


FIG. 3.—*Lonchocarpus affinis*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Rose & Hough 4278.

former usually biflorous, 1 to 2 mm. long, the latter 2 to 3 mm. long; bracts oblong, very small, hairy, caducous, the latter a little distant from the calyx. Calyx cupulate, about 2.5 mm. long, ferruginous-hairy, 5-toothed, the two vexillar teeth rounded and connate, the carinal tooth longer and prominent. Petals purplish, turning to white toward the base; standard suborbicular (broader than long), concave, bilobulate and callous-plicate at the base, emarginate at the apex, densely fulvous-pubescent on both sides of the median line without, the claw obliquely inserted, 1.5 to 2 mm. long, the blade about 6 mm. long and 7 mm. broad; wings obliquely oblong, auriculate, plicate on the upper margin, sparsely hairy along the longitudinal veins, the claw about 2.5 mm. long, the blade 5 mm. long, 2 to 2.5 mm. broad; carinal petals falcate, broadly rounded at the apex, sparsely and minutely ferruginous-pubescent without along the main veins next to the carinal margin, the claw as in the wings, the blade 5 mm. long and 3 mm. broad.

Vexillar stamen free at the base; staminal tube and filaments glabrous. Ovary linear, sessile, densely fulvous-hairy, about 5 mm. long, 2-ovulate; style glabrous, abruptly geniculate, straight and exceeding the stamens; stigma capitate.

Legume lanceolate-elongate, attenuate and short-stipitate at the base, rounded and apiculate at the apex, 1 or 2-seeded, 5.5 to 9 cm. long, 1.6 to 1.8 cm. broad, thin and submembranous, fulvescent, softly hairy or glabrescent, the vexillar margin narrowly 3-winged, the carinal margin slightly thickened. Seeds reniform, flat, purplish, about 10 mm. long, 5 mm. broad.

Type in the U. S. National Herbarium, no. 48926, collected at Orizaba, State of Veracruz, Mexico, by Botteri (no. 348).

OTHER SPECIMENS EXAMINED:

MEXICO: Vicinity of Orizaba, in fruit, August 4, 1866, *Bourgeau* 2834. Near Jalapa, Veracruz, May 17 to 22, 1899, *Rose & Hough* 4278.

This species agrees closely with *Lonchocarpus velutinus* Benth. in most details, but is specifically differentiated by the number and shape of the leaflets, the pubescence of the flowers, the characters of the fruits, and the shape, size, and color of the seeds.

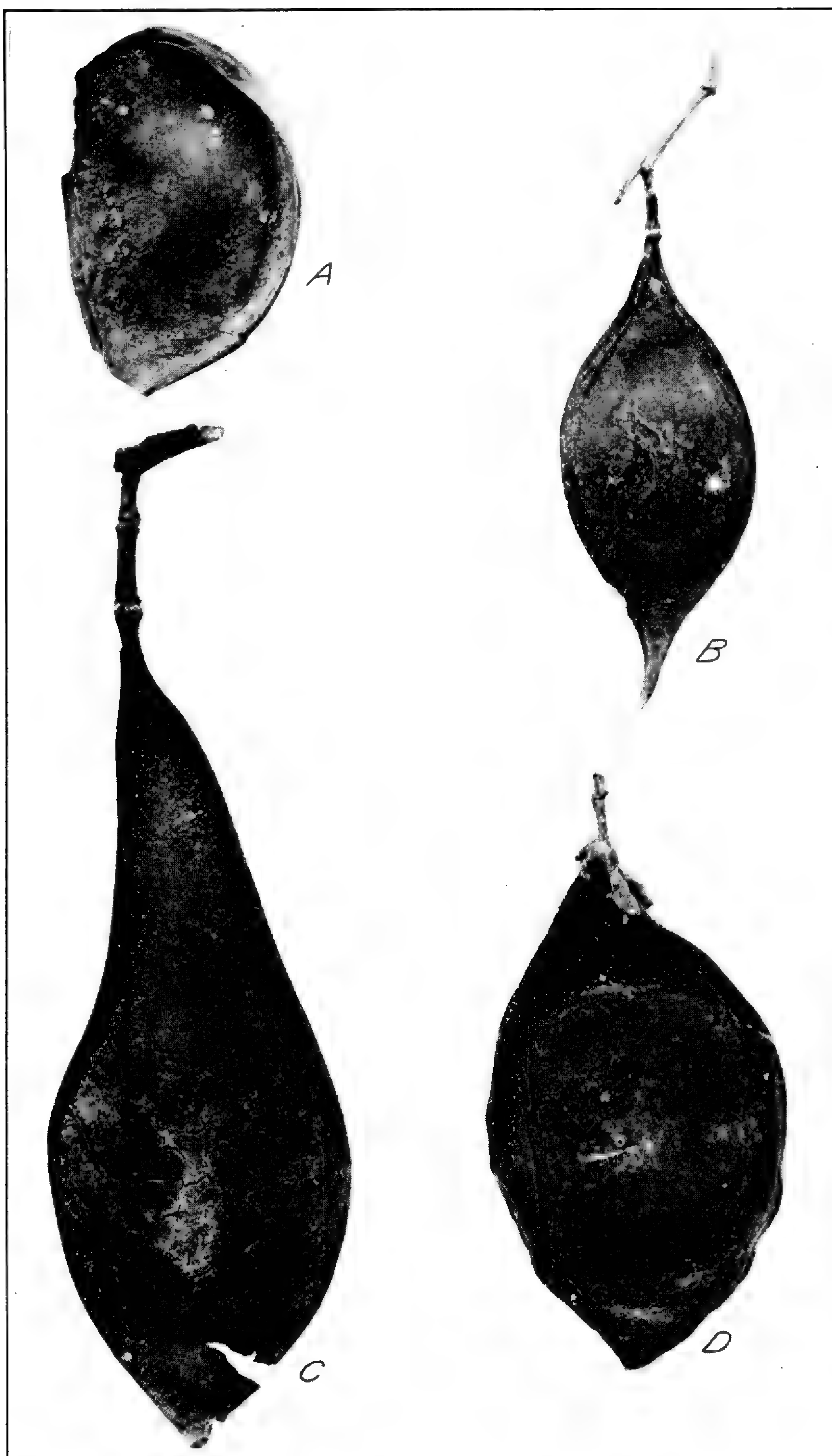
EXPLANATION OF PLATE 1.—See p. 54.

4. *Lonchocarpus peninsularis* (Donn. Smith) Pittier. PLATE 2, A. FIGURE 4.

Derris peninsularis Donn. Smith, Bot. Gaz. 44: 111. 1907.

A tree, the branchlets brownish, glabrous, minutely lenticellate.

Leaves 5-foliolate, the rachis glabrous, canaliculate, 8 to 12 cm. long. Leaflets submembranous, the petiolules canaliculate, glabrous, 7 to 8 mm. long, the blades obovate, ovate-lanceolate, or elliptic, acute at the base, more or less abruptly obtuse-



FRUITS OF (A) *Lonchocarpus peninsularis* (Donn. Smith) Pittier, (B) *L. nicoyensis* (Donn. Smith) Pittier, (C) *L. costaricensis* (Donn. Smith) Pittier, and (D) *L. eriocarinalis* Micheli.

acuminate at the apex, 4.5 to 8.5 cm. long, 1.5 to 4 cm. broad, glabrous or sparsely puberulous above, minutely and densely cano-pubescent beneath, the costa and veins immersed above, slightly prominent beneath.

Racemes axillary, subpaniculate at the ends of the branchlets, the rachis slender, glabrous or sparsely puberulous, 6 to 8 cm. long. Peduncles and pedicels sparsely grayish-pubescent, the former usually biflorous, 1 to 2.5 mm. long, the latter 1 to 1.5 mm. long; bracts and bractlets very small, scalelike, orbicular, ciliate on the margin, the bractlets inserted on the middle of the pedicels. Calyx cupulate, about 3.5 mm. long, truncate, glabrescent or puberulous, obscurely ciliate. Petals pink, dark-spotted; standard suborbicular, concave, callous-biplicate at the base, emarginate at the apex, minutely grayish-pubescent without above the insertion of the claw, sparsely so along the main veins, the claw obliquely inserted, about 2 mm. long, the blade about 8 mm. long and 9 mm. broad (broadest at the base), the margins inflexed; wings oblong, oblique, auriculate, glabrous, the claw about 2.7 mm. long, the blade about 7 mm. long and 3 mm. broad; carinal petals falcate, obtuse, auriculate or subauriculate, minutely grayish-pubescent at the apex, the claw as in the wings, the blades 6.5 mm. long, 3.2 mm. broad. Staminal tube glabrous, the vexillar stamen free at the base. Ovary sessile, linear, minutely grayish-pubescent, about 4 mm. long, 4-ovulate; style pilosulous; stigma inconspicuous.

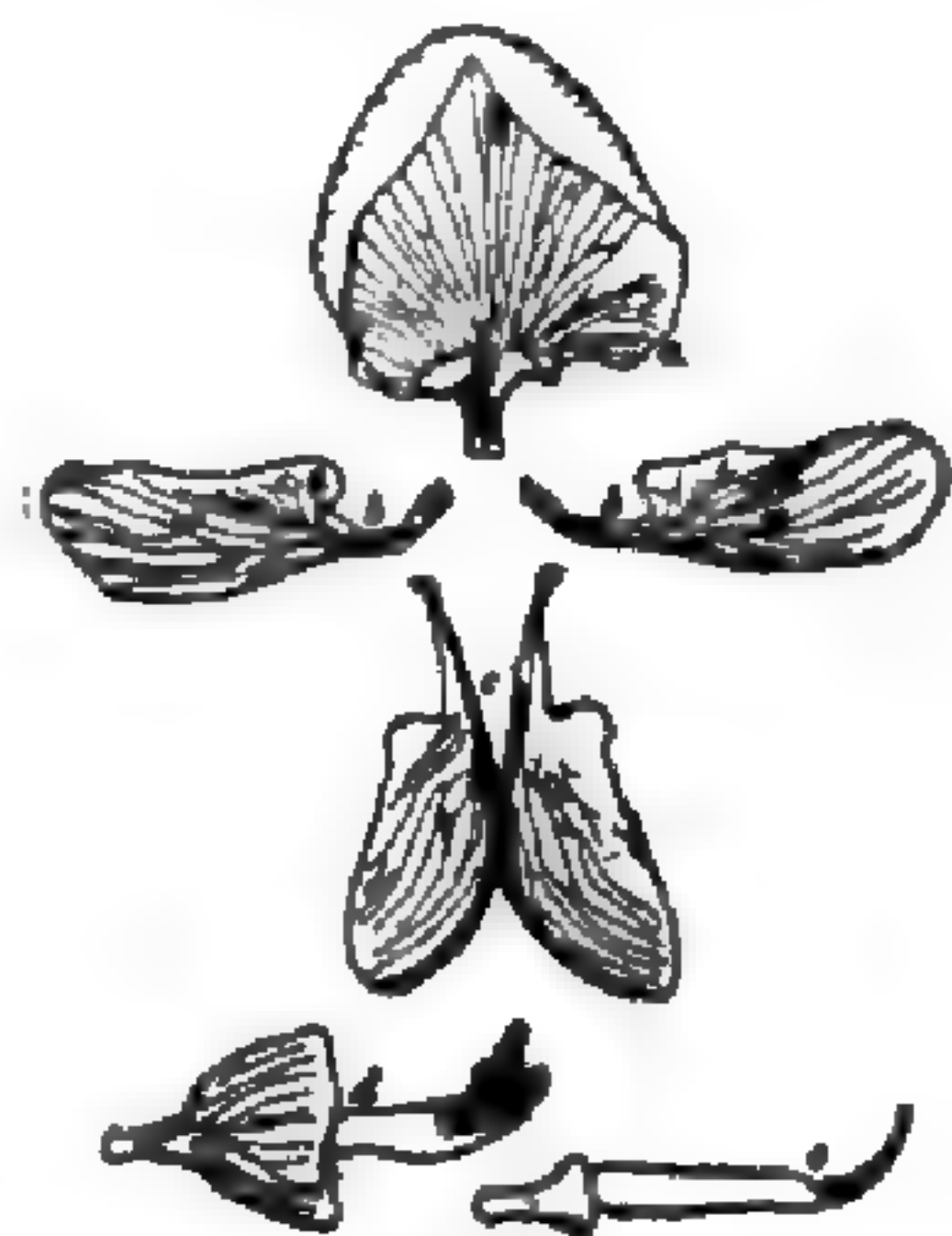


FIG. 4. — *Lonchocarpus peninsularis*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From *Inst. Fís. Geogr. Costa Rica* 13966.

Legume coriaceous, ovate-oblique or broadly crescent-shaped, light brown, 1-seeded, about 6.5 cm. long, 3 to 3.5 cm. broad, glabrous, rarely 2-seeded and then about 10 cm. long, the vexillar margin slightly winged, 2 mm. broad, the carinal margin strongly incurved or inflexed. Seeds reniform, lustrous, dark brown, about 11 mm. long, 21 mm. broad.

Type in the John Donnell Smith Herbarium, collected in the forested hills around Nicoya, Costa Rica, in flower, May, 1900, by A. Tonduz (*Inst. Fís. Geogr. Costa Rica*, nos. 13961, 13966).

Other specimens (*Inst. Fís. Geogr. Costa Rica*, no. 13812) were collected in flower in the same locality, also by Mr. Tonduz. The fruits accompanying the last specimen, in the U. S. National Herbarium, are all detached. In his description, Capt. Smith does not mention the remarkably recurved carinal margin.

The vernacular name of the species is "chaperno." This tree produces one of the hardest timbers in the country.

My reasons for not including this species and the two following in the genus *Derris* are given elsewhere.¹

5. *Lonchocarpus nicoyensis* (Donn. Smith) Pittier. PLATE 2, B. FIGURE 5.

Derris nicoyensis Donn. Smith, *Bot. Gaz.* 44: 111. 1907.

A shrub or small tree, the branchlets grayish, glabrous, minutely lenticellate.

Leaves, 5-foliolate, the rachis glabrous, canaliculate, 7.5 to 10 cm. long. Leaflets coriaceous, the petiolules canaliculate, 6 to 8 mm. long, the blades broadly ovate, acute at the base, at first acutely acuminate, obtusely so in fruiting specimens, 5 to 9 cm. long, 2.5 to 5 cm. broad, glabrous above, the costa and veins impressed, beneath minutely grayish-pubescent, the costa and veins glabrous and prominent.

¹ P. 40 above.

EXPLANATION OF PLATE 2.—Fruits of 4 species of *Lonchocarpus*. Fig. A, *L. peninsularis*, from type collection (*Inst. Fís. Geogr. Costa Rica*, no. 13966); fig. B, *L. nicoyensis*, type collection (*Inst. Fís. Geogr. Costa Rica*, no. 13547); fig. C, *L. costaricensis*, from Pittier 3654; fig. D, *L. eriocarinalis*, from Palmer 984. Natural size.

Racemes axillary, densely flowered, the rachis more or less pilosulous or pubescent, 6 to 9 cm. long. Peduncles and pedicels grayish-pubescent, the former usually biflorous, about 1 mm. long, the latter 1.5 to 2.5 mm. long; bracts and bractlets very small, ovate, scarious, ciliate, the bractlets opposite, inserted at the base of the calyx stipe. Calyx cupulate, turbinate or stipitate at the base, shallowly sinuate-dentate, 4 to 4.5 mm. long, minutely puberulous, longitudinally dark-striped. Petals crimson or red, thick, obscurely spotted; standard suborbicular, callous-plicate and subauriculate at the base, emarginate at the apex with the margin more or less inflexed, densely silvery-pubescent above the claw and along the veins without, the claw about 2 mm. long, the blade 9 mm. long, 10 mm. broad; wings long, narrow, arcuate, auriculate, rounded-obtuse at the apex, glabrous, the claw 2.6 mm. long, the blade 7 mm. long, 2 mm. broad; carinal petals strongly falcate, subauriculate, rounded at the apex, slightly pubescent without along the veins, the claw 3.2 mm. long, the blade about 6.5 mm. long, 2.5 mm. broad. Staminal tube glabrous. Ovary linear, long-stipitate, densely and minutely cano-pubescent, about 5.5 mm. long, 4-ovulate; style arcuate, sparsely pubescent; stigma capitellate.

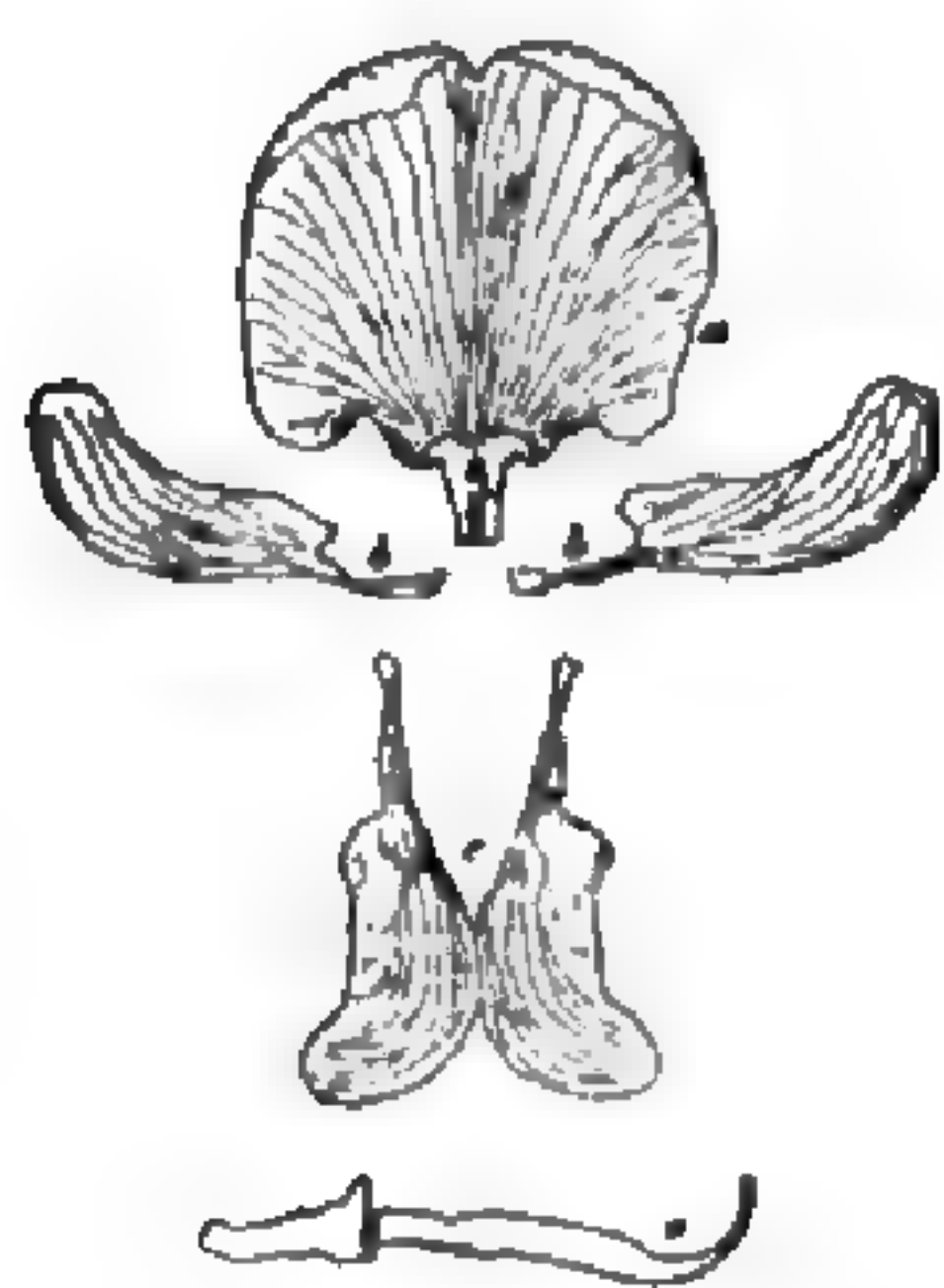


FIG. 5.—*Lonchocarpus nicoyensis*. a, Standard; b, wings; c, carinal petals; d, pistil. Natural size. From *Inst. Fís. Geogr. Costa Rica* 13812.

Legume ovate-lanceolate, attenuate and substipitate at the base, long-acuminate at the apex, light brown, glabrous, 6.5 cm. long, 2.8 cm. broad, 1-seeded, the vexillar margin about 2 mm. broad, the carinal margin somewhat rounded. Seed dark brown, reniform, 11 mm. long, 18 mm. broad.

Type in the John Donnell Smith Herbarium, collected on the wooded hills around Nicoya, Costa Rica, December, 1899, in fruit, by A. Tonduz (*Inst. Fís. Geogr. Costa Rica*, no. 13547).

ADDITIONAL SPECIMENS EXAMINED:

COSTA RICA: Around Nicoya, in thickets, in flower, January, 1900, *Tonduz* (*Inst. Fís. Geogr. Costa Rica*, no. 13812); in flower, May, 1900, *Tonduz* (*Inst. Fís. Geogr. Costa Rica*, no. 13961).

Lonchocarpus peninsularis and *L. nicoyensis* are known among the natives under the common name of "chaperno," a fact that seems to have brought about an almost hopeless confusion of the collections distributed by Mr. Tonduz. Thus the flowers of the latter were attributed to the former and vice versa. It seems, however, that both species are quite distinct and hardly need be confused. *Lonchocarpus nicoyensis* is probably always a shrub, and its leaves are fully developed before the appearance of the flowers. These are noted by Mr. Tonduz as being red, while those of *L. peninsularis* are pinkish; furthermore the petals of the former species are unusually thick, and the wings assume a falcate, elongate shape exceptional in the genus. Lastly, the fruits are quite distinct.

6. *Lonchocarpus costaricensis* (Donn. Smith) Pittier. PLATE 2, C. FIGURE 6.
Derris costaricensis Donn. Smith, *Bot. Gaz.* 44: 110. 1907.

A deciduous tree, the branchlets thick, the grayish bark at first densely tomentose, later glabrous; young shoots densely reddish brown tomentose.

Leaves 5 or 7-foliolate, the rachis 9 to 12 cm. long, terete, at first densely reddish-tomentose, later grayish brown pubescent. Leaflets coriaceous, the petiolules thick, canaliculate, about 7 mm. long, reddish brown tomentose, the blades broadly ovate to obovate, shortly cuneate at the base, rounded-emarginate at the apex, 6 to 12 cm. long, 4 to 11 cm. broad, at first velvety, later sparsely pubescent, impressed-reticulate above, reticulate and grayish-tomentose beneath; costa and primary nerves reddish brown hairy on both faces, slightly prominent above, strongly so beneath. Stipules short, broad, rounded at the apex, reddish brown hairy.

Racemes (not perfectly developed) axillary and subpaniculate at the ends of the branchlets, short, few-flowered, the rachis reddish brown tomentose. Peduncles and pedicels fuliginous-tomentose, the former 1 or 2-florous, 3 to 4 mm. long, the latter 3 to 6 mm. long; bracts and bractlets linear, hairy, up to 8 mm. long, the latter close to the base of the calyx. Calyx tubular-campanulate, fuliginous-tomentose, 5-toothed, the carinal tooth long and linear. Petals pink or purplish; standard suborbicular (broader than long), callous-plicate at the base, emarginate at the apex, concave, softly hairy without, the claw 4 mm. long, the blade 12 mm. long, 14 mm. broad; wings obovate-oblique, scarcely auriculate, rounded-obtuse at the apex, glabrous, the claw about 6.5 mm. long, the blade 8.5 mm. long, 4.5 mm. broad; carinal petals falcate, subauriculate, obtuse, densely hairy without, the claw nearly 6 mm. long, the blade 9 mm. long, 4 mm. broad. Staminal tube glabrous, strongly dilated at the base. Ovary linear, cano-pubescent, about 7 mm. long, 1 or 2-ovulate; style glabrescent; stigma inconspicuous.

Legume ovate-elliptic or obovate-lanceolate, 1 or 2-seeded, 12.5 to 16 cm. long, 4 cm. broad, cuneate-attenuate at the base, obtuse or rounded and apiculate at the apex, the cinnamon-colored surface pubescent, the marginal nerve narrow and subacute; pedicel thick, 13 mm. long, dark brown pubescent. Seeds dark brown, reniform, 2 cm. long, 1 cm. broad.

Type from Costa Rica (see below).

SPECIMENS EXAMINED:

COSTA RICA: Nicoya, forested hills of the Pacific seaboard, in flower and fruit, May, 1900, *Tonduz* (Inst. Fís. Geogr. Costa Rica, no. 13993 in John Donnell Smith Herb., type); floral buds and fruits, January, 1900, *Tonduz* (Inst. Fís. Geogr. Costa Rica, nos. 13528, 13532). Salinas Bay, dry forests, fruits, July, 1890, *Tonduz*. La Balsa del Río Grande, Province of Alajuela, fruits, June 2, 1911, *Pittier* 3654.

This is distinguished from the single other Middle American species of the group, *Lonchocarpus eriocarinalis*, by its large leaflets and fruits, the thick velvety indument covering the young leaves, the long, unguiculate petals, the very broad and peculiarly shaped wings, etc. It is known among the natives of Nicoya as "siete-cueros," i. e., "seven hides," a name applied to several hard timbers and referring to the toughness of the wood, which causes the hand to blister to the deepest layer of the skin. The tree does not shed its bark as supposed by Captain Smith.

EXPLANATION OF PLATE 2.—See p. 57.

7. *Lonchocarpus eriocarinalis* Micheli, Mém. Soc. Phys. Hist. Nat. Genève 34: 267. 1903.

PLATE 2, D. FIGURE 7.

A tree 6 to 8 meters high, the branchlets lenticellate, more or less grayish brown tomentose.

Leaves 7 to 11-foliolate, the rachis terete, subcanaliculate, brownish-tomentose, 7 to 12 cm. long. Leaflets coriaceous, the petiolules densely hairy, 4 to 5 mm. long, the blades ovate, rounded at the base, obtuse and emarginate at the apex, 3 to 6.5 cm. long, 2 to 3.8 cm. broad, sublustrous and sparsely pilosulous above, the costa and veins hairy and deeply immersed, sparsely pubescent beneath, reticulate, the costa and veins very prominent. Stipules small, hairy, early deciduous.

Racemes simple, axillary and paniculate at the ends of the branchlets, the rachis hairy or subtomentose, terete, 4 to 11 cm. long. Peduncles and pedicels tomentose,

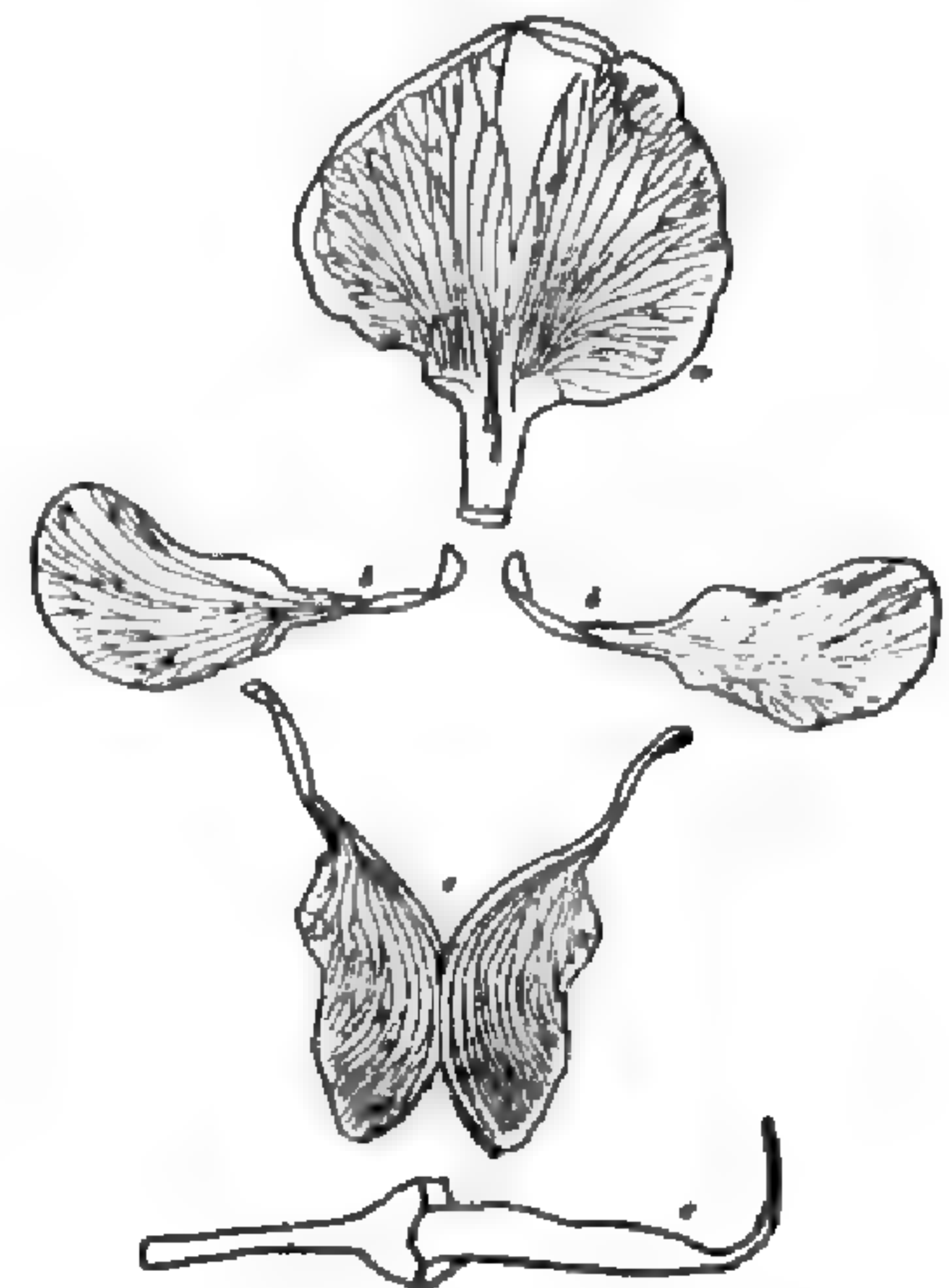


FIG. 6.—*Lonchocarpus costaricensis*. a, Standard; b, wings; c, carinal petals; e, pistil. Natural size. From *Inst. Fís. Geogr. Costa Rica* 13528.

the former usually biflorous, 3 to 5 mm. long, the latter 2 to 3 mm. long; bracts and bractlets very small, ovate-oblong, hairy, the latter inserted slightly above the middle of the pedicel. Calyx cupulate, densely fulvous-pubescent without, 4 to 4.5 mm.

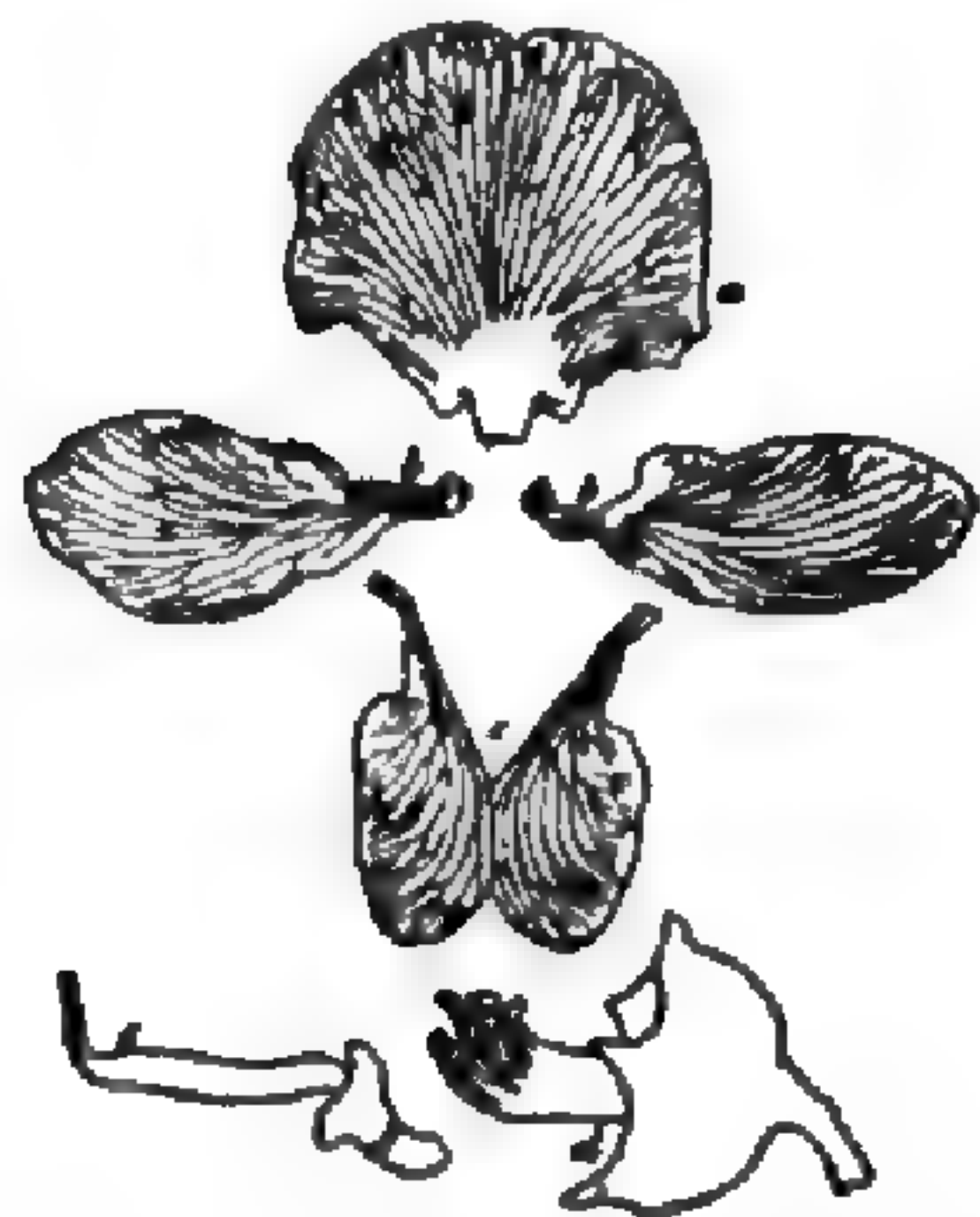


FIG. 7.—*Lonchocarpus eriocarinalis*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From *Langlassé* 320.

long, distinctly 5-toothed, the 2 carinal teeth largest, the vexillar one smallest. Petals deep red; standard broadly orbicular, bilobulate at the base, emarginate at the apex, almost flat, densely silky-villous without, the margins inflexed, the claw oblique, about 1 mm. long, the blade 8.5 mm. long, 9.5 mm. broad; wings ovate, auriculate, adhering to the keel, glabrous, the claw about 3 mm. long, the blade 8.5 mm. long, 3 to 3.5 mm. broad; carinal petals ovate, obtuse, subauriculate, densely silky-villous without, the claw as in the wings, the blade 5 to 5.5 mm. long, 3.5 mm. broad. Vexillar stamen free at the base, the staminal tube short and broad. Ovary linear, stipitate, densely tomentose, about 4.5 mm. long, 2 or 3-ovulate; style sharply recurved, relatively long, tomentose at the base; stigma capitellate.

Legume broadly ovate-lanceolate, compressed, attenuate at the base, obtuse at the apex, densely rufous-tomentose, 1 or rarely 2 or 3-seeded, 7 to 8.5 cm., or when 2 or 3-seeded up to 10 or 11.5 cm. long, 3.5 to 4 cm. broad. Seeds reniform, dark brown with white hilum, 15 mm. broad, nearly 10 mm. long, and 2 mm. thick.

SPECIMENS EXAMINED:

MEXICO: El Valle Grande, Guerrero, alt. about 400 meters, September 5, 1898, in flower, *Langlassé* 320 (type collection, a specimen in U. S. Nat. Herb.).

Near Acapulco, Guerrero, in flower and fruit, October, 1894, to March, 1895, *Palmer* 226. Near Manzanillo, Colima, in fruit, December, 1890, *Palmer* 984.

The common name of the species is "palo de oro," an allusion to the golden hue of the flower masses.

Closely related to *Lonchocarpus rugosus* Benth., but departing from it in the arrangement of the inflorescence, the size and color of the flowers, the shape and dimensions of the fruits, the number of the leaflets, etc.

EXPLANATION OF PLATE 2.—See p. 57.

8. *Lonchocarpus jaliscensis* Pittier, sp. nov.

A shrub or a small tree, the bark of the trunk and larger limbs gray and verruculose, that of the branchlets brownish and lenticellate; young shoots more or less puberulous.

Leaves 7 to 13-foliolate, the rachis canaliculate, fulvous-hairy, 6.5 to 13.5 cm. long. Leaflets subcoriaceous, the petiolules densely hairy, 3 to 4 mm. long, the blades orbicular-ovate, obovate, or oblong, rounded at the base, obtuse and sometimes emarginate at the apex, 1.5 to 5 cm. long, 1.5 to 2.5 cm. broad, puberulous or glabrescent above, the costa and veins immersed, softly hairy beneath, the costa and veins prominent, the margins revolute.

Flowers not known.

Legume ovate-lanceolate, shortly attenuate-stipitate at the base, obtuse at the apex, 1-seeded, about 4 cm. long, 2 to 2.5 cm. broad, dark brown hairy without, the margin thin-edged, broader on the vexillar side. Seed reniform, thick, reddish brown, about 8 mm. long and 14 mm. broad.

Type in the U. S. National Herbarium, no. 301874, collected at Bolaños, State of Jalisco, Mexico, in fruit, September, 1897, by J. N. Rose (no. 2923).

Although the only specimen is rather incomplete, it is sufficient to show distinct specific characters, the place of the species being close to *Lonchocarpus eriocarinalis* Micheli, from which it differs principally in the smaller leaves and legumes.

9. *Lonchocarpus longipedicellatus* Pittier, sp. nov.

FIGURE 8.

A tree, the branchlets terete, grayish, more or less villous and pubescent.

Leaves 7 or 9-foliolate, the rachis semiterete, canaliculate, glabrescent or sparsely hairy, 7 to 12 cm. long. Leaflets membranous or subcoriaceous, pellucid-punctate, the petiolules canaliculate, minutely puberulous or glabrescent, about 4 mm. long, the blades mostly oblong, sometimes ovate, rounded at the base, obtuse or emarginate or sometimes with a short obtuse acumination at the apex, 3.5 to 10.5 cm. long, 2 to 5 cm. broad, light green and glabrous above, paler beneath, the costa and veins prominent and more or less pilosulous. Stipules oblong, about 2 mm. long, densely whitish-tomentose at the apex, caducous.

Racemes axillary, usually 1 or 2 at the ends of the branchlets, the rachis more or less puberulous, 12 to 18 cm. long. Peduncles and pedicels puberulous at first, glabrous later, the former slender, solitary or geminate, biflorous, about 1.3 cm. long, the latter about 0.7 cm. long; bracts and bractlets ovate, very small, scarious, ciliate, the latter opposite and inserted about the middle of the pedicels. Calyx broadly cupulate, truncate, glabrous or pilosulous without, more or less gland-dotted, about 5 mm. long. Petals pale purple (?), densely pellucid-punctate; standard orbicular, suboblique, bilobulate at the base, emarginate at the apex, slightly pubescent without above the insertion of the claw, this about 2.5 mm. long, the blade 13 mm. long and broad; wings oblong, auriculate at the base on the vexillar margin, rounded-obtuse at the apex, the claw slender, 5 to 5.5 mm. long, the blade 10.5 mm. long, 5 mm. broad; carinal petals falcate, subauriculate at the base, obtuse, pubescent along the carinal line, the claw as in the wings, the blade pubescent along the carina, 9 mm. long, 4 mm. broad. Vexillar stamen free at the base. Ovary sessile, linear, minutely pubescent or puberulous, about 9 mm. long, 3 or 4-ovulate, the style arcuate, subulate, glabrous, the stigma capitellate, very small.

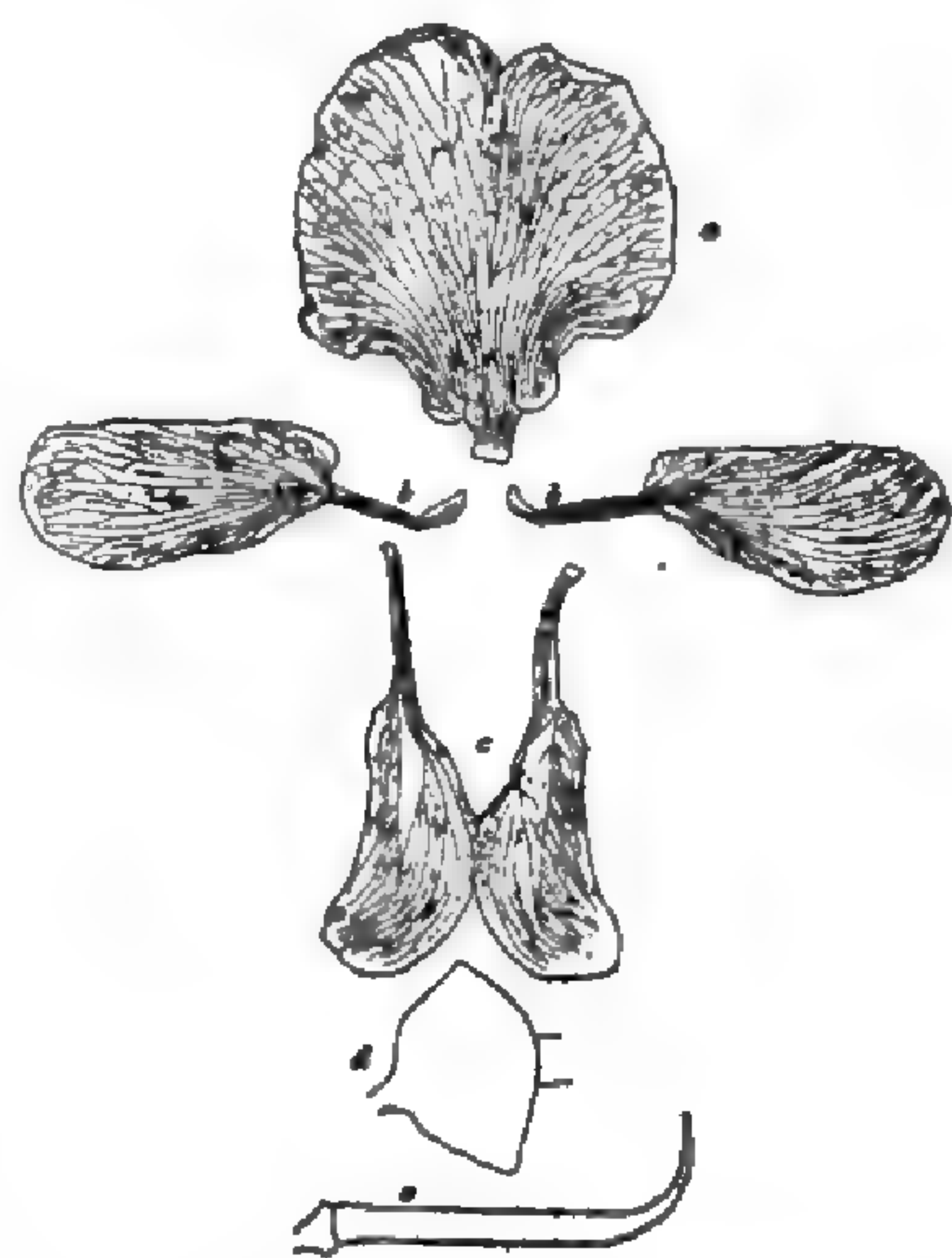


FIG. 8.—*Lonchocarpus longipedicellatus*. a, Standard; b, wings; c, carinal petals; d, calyx; e, pistil. Natural size From Goldman 1030.

Legume not known.

Type in the U. S. National Herbarium, no. 470825, collected at Jiquipilas, State of Chiapas, Mexico, in flower, May 31, 1904, by E. A. Goldman (no. 1030).

This species is a near relative of *L. punctatus* H. B. K., but differs in the glabrescent or slightly hairy leaves, the appearance of the glandular dots, the shape and dimensions of the leaflets, the relative length of the peduncles and pedicels, the absence of the dark vexillar spot, and the shape of the wings and carina, as well as in other minor details.

10. *Lonchocarpus michelianus* Pittier, sp. nov.

FIGURE 9.

Branchlets grayish, minutely lenticellate, the younger parts more or less pubescent.

Leaves mostly 9-foliolate, sometimes 7-foliolate, the rachis broadly sulcate, pubescent, 7 to 12 cm. long. Leaflets membranous, minutely pellucid-punctate, the petiolules subcanaliculate, pubescent, 5 to 6 mm. long, the blades ovate or ovate-elliptic, more or less oblique, subacute at the base, shortly acute-acuminate at the apex, 3.5 to 7 cm. long, 2 to 3.3 cm. broad, sparsely pubescent except on the hairy costa above, densely grayish-pubescent beneath, the costa and veins prominent. Stipules small, ovate, grayish-hairy, early deciduous.

Racemes sparse, axillary, few-flowered, the rachis pilosulous, 7 to 10 cm. long, flower-bearing only on its upper third, the peduncles and pedicels pubescent, the former solitary, biflorous, 4 to 5 mm. long, the latter 6 to 7 mm. long; bracts and bractlets very

small, oblong, hairy, caducous, the latter opposite, close to the calyx. Calyx broadly cupulate, truncate, about 4.5 mm. long, sparsely grayish-pubescent without. Petals purplish or pinkish, irregularly dotted or spotted (under the lens); standard suborbicular, concave, emarginate at the apex, the basal lobules hardly prominent, the



FIG. 9.—*Lonchocarpus michelianus*. a, Standard; b, wings; c, carinal petals; d, calyx; e, pistil. Natural size. From J. D. Smith 4468.

claw strongly arcuate, 3 to 3.5 mm. long, the blade densely silvery-pubescent at the base, sparsely so toward the margin without, sparsely pubescent and darker colored at the base within, 12.5 to 13 mm. long and broad; wings oblique, oblong, rounded-auriculate at the base on the vexillar margin, obtuse at the apex, very sparsely pilosulous without, the claw about 5 mm. long, the blade 10.5 mm. long, 4.5 mm. broad; carinal petals falcate, rounded-auriculate on the vexillar margin, convex, obtuse at the apex, sparsely pilosulous without, the claw 5 mm. long, the blade about 11 mm. long, 4.5 mm. broad. Vexillar stamen free at the base. Ovary sessile, linear, velvety-pubescent, 9.5 mm. long, 3 or 4-ovulate; style arcuate, glabrescent, the stigma very small.

Legume not known.

Type in the U. S. National Herbarium, no. 246518, collected at El Naranjo, Department of Santa Rosa, Guatemala, at an altitude of about 1,200 meters, in flower, May, 1893, by Heyde and Lux (J. D. Smith, no. 4468).

Determined as *L. violaceus* (Beauv.) H. B. K. by the late Micheli, this species departs from *L. benthamianus* in its general pubescence, the shape of the leaflets, the arrangement of the inflorescence, and the less prominent lobules of the standard, and also in its distinct habitat, the latter growing on cliffs near the seashore, while *L. michelianus* is a mountain tree.

11. *Lonchocarpus longistylus* Pittier, sp. nov.

A tree, the branchlets brownish, glabrous, lenticellate.

Leaves 11 to 15-foliolate, glabrous, the rachis terete, 8 to 20 cm. long. Leaflets membranous, pellucid-punctate, the petiolules canaliculate, 4 to 5 mm. long, the blades mostly oblong, sometimes ovate, oblique (the lateral ones), subacute at the base, acute-acuminate at the apex, 3.5 to 8.5 cm. long, 1.5 to 3.5 cm. broad, minutely reticulate, dark green above, grayish or fulvous (almost glaucescent) with a prominent costa beneath. Stipules not seen.

Racemes axillary, subpaniculate at the ends of the branchlets, the rachis subangulate, glabrous, 14 to 17.5 cm. long. Peduncles and pedicels glabrous, 5 mm. long, the former biflorous; bracts and bractlets very small, oblong, acute, ciliate, caducous, the latter opposite, distant from the calyx. Calyx broadly cupulate, rounded at the base, truncate or subdenticulate, 4 to 4.5 mm. long, glandular-dotted, glabrous, minutely ciliate. Petals purplish; standard orbicular (shorter than broad), 10.5 to 11 mm. long, 12.5 to 13 mm. broad, more or less oblique, emarginate at the apex, minutely silky-pubescent on both sides above the insertion of the claw and along the veins, the basal lobes lateral, the claw 1.5 to 2 mm. long; wings oblique, obovate, obtuse, rounded-auriculate at the base on the

FIGURE 10.

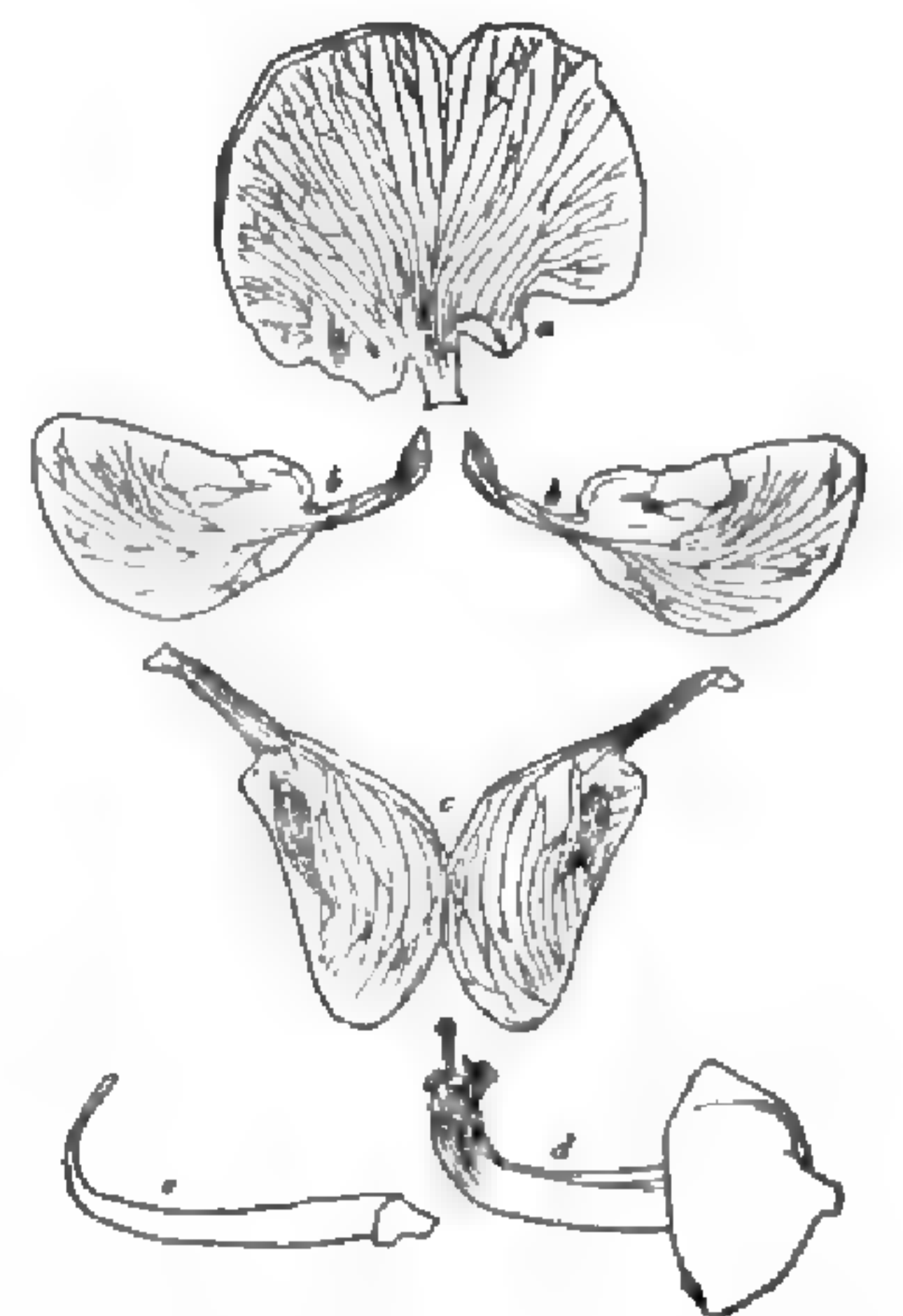
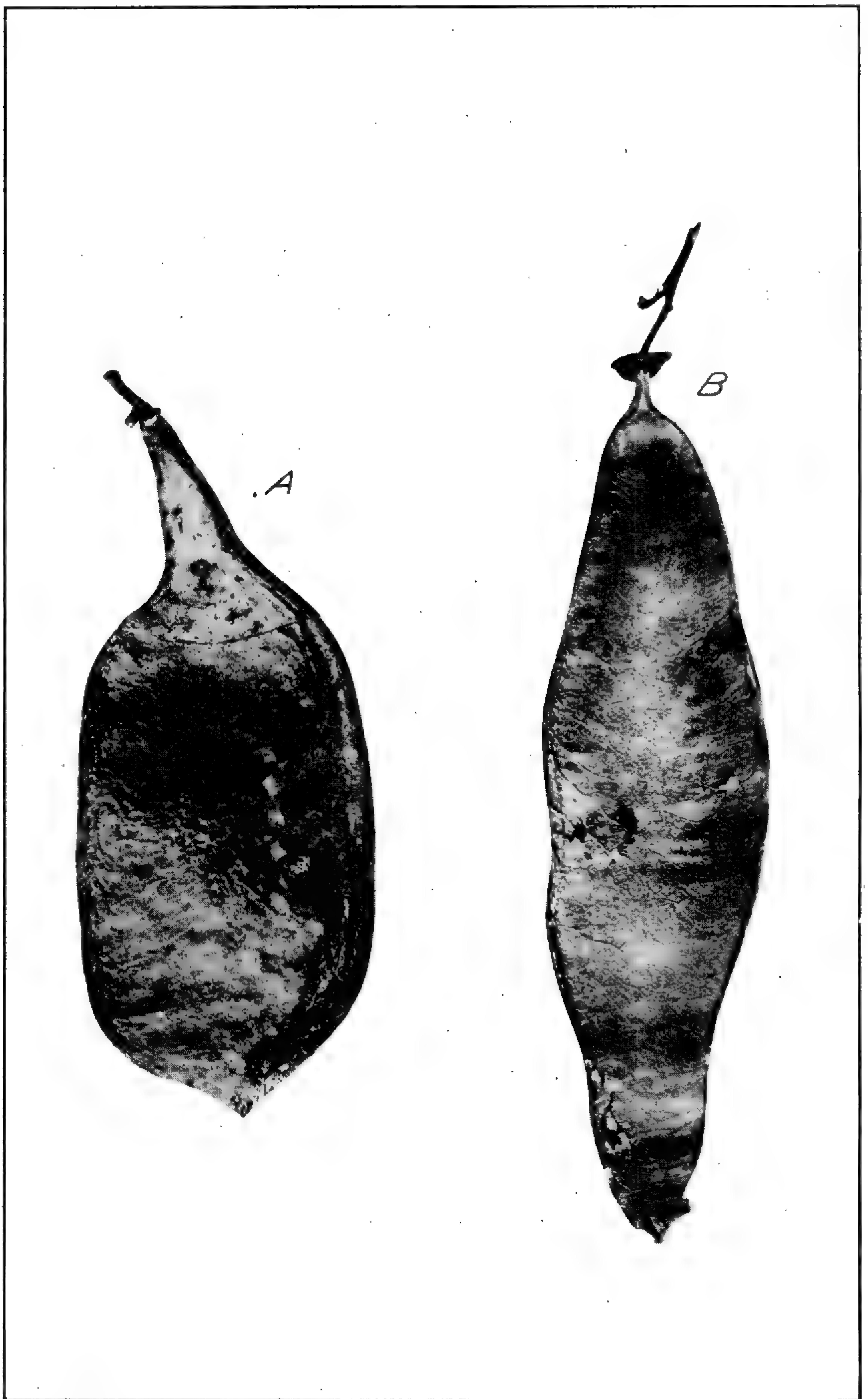


FIG. 10.—*Lonchocarpus longistylus*. a, Standard; b, wings; c, carinal petals; d, calyx, stamens, and style; e, pistil. Natural size. From Gaumer 904.



FRUITS OF (A) *Lonchocarpus chiricanus* Pittier and (B) *L. proteranthus* Pittier.

carinal side, almost glabrous, the claw 4.5 to 5 mm. long, the blade 10 mm. long, 5 to 5.5 mm. broad; carinal petals falcate, rounded-auriculate at the base, obtuse at the apex, the claw 4.5 mm. long, the blade folded near the base, sparsely silky-pubescent without and within, 10 mm. long, 4.5 to 5 mm. broad. Vexillar stamen free at the base. Ovary sessile, linear, 3.5 mm. long, 8-ovulate, silky-pubescent; style arcuate, pilosulous, exceeding the stamens, the stigma capitellate.

Legume coriaceous, ovate-lanceolate, compressed, attenuate-stipitate at the base, rounded-mucronate at the apex, glabrous, 1 or 2-seeded, 8 to 8.5 cm. long, 3 cm. broad, both margins thin-edged.

Type in the herbarium of the Field Museum of Natural History, collected at Xbalché, Yucatán, Mexico, by Dr. G. F. Gaumer (no. 904).

OTHER SPECIMENS EXAMINED:

YUCATÁN: Mucuyché, in flower, December 20, 1865, *Schott* 691. Cozumel Island, *Gaumer*.

Maya name "bal-ché," or "xbal-ché."

Closely related perhaps to *L. punctatus* H. B. K., but differing in the number, shape, and dimensions of the leaflets, the ciliate, glandular calyx, and the size and shape of the petals and legume.

12. *Lonchocarpus chiricanus* Pittier, sp. nov.

PLATE 3, A.

A small deciduous tree, the branchlets grayish, glabrous, lenticellate.

Leaves 7 or 9-foliolate, the rachis subterete, canaliculate, glabrous, thicker at the insertion, 10 to 12 cm. long. Leaflets coriaceous, densely pellucid-punctulate, the petiolules canaliculate, thick, 6 to 7 mm. long, the blades ovate or obovate, rounded at the base, subacuminate and obtuse at the apex, 6.5 to 11 cm. long, 4.5 to 6 cm. broad, dark green and sublustrous above, paler (almost glaucous) and minutely pilosulous beneath, the costa and veins glabrous and prominent. Stipules not known.

Flowers not known.

Legume flattened, club-shaped, ovate, long-stipitate at the base, abruptly acuminate at the apex, glabrous, subligneous with a suberous mesocarp, 1-seeded, about 10 cm. long and 4 cm. broad, both margins thin-edged and sharp. Seed reniform, rich brown with a whitish hilum, about 2.3 cm. long, 1.5 cm. broad, and 6 mm. thick.

Type in the U. S. National Herbarium, no. 677284, collected on Parida Island, Province of Chiriquí, Panama, in fruit, February 25, 1911, by H. Pittier (no. 2817).

The transparent-dotted leaflets indicate that the place of this species is in the section *Punctati*; the characters of the legume and seed show that it is distinct from *L. benthamianus* and *L. proteranthus*; the presence of the minute pubescence on the lower face of the leaves, presumably the remnants of a denser initial indument, almost excludes the possibility of the specimens belonging to *L. punctatus* or *L. longipedicellatus*, etc. Notwithstanding the absence of the flowers, it seems permissible to consider this tree a distinct species.

13. *Lonchocarpus proteranthus* Pittier, sp. nov.

PLATE 3, B. FIGURE 11.

A tree 15 to 20 meters high, the trunk 35 to 40 cm. in diameter at the base, the branchlets sparsely lenticellate, the young growth glabrous or puberulous.

Leaves mostly 9-foliolate, glabrous, the rachis 10 to 14 cm. long, subterete, thickened at the base. Leaflets petiolulate, coriaceous, pellucid-punctate, the petiolules 7 mm. long, narrowly canaliculate, dark greenish brown, the blades ovate-oblong, broadly rounded at the base, shortly and obtusely acuminate at the apex, 3.5 to 9 cm. long, 2.3 to 3.8 cm. broad, the venation finely reticulate and prominent on both faces. Stipules not seen.

EXPLANATION OF PLATE 3.—Fruits of 2 species of *Lonchocarpus*. Fig. A, *L. chiricanus*, from the type specimen, *Pittier* 2817; fig. B, *L. proteranthus*, from the type specimen, *R. S. Williams* 418. Natural size.

Racemes subaxillary, paniculate at the ends of the branchlets, the rachis 3 to 8 cm. long, minutely pilosulous. Peduncles and pedicels pubescent, the former solitary, biflorous, 3 to 4 mm. long, the latter slender, about 5 mm. long; bracts and bractlets ovate-orbicular, pubescent, very caducous, the latter opposite and close to the base of the calyx. Calyx broadly cupuliform, subturbinate at the base, truncate, about 5.5 mm. long, grayish-pubescent without and on the margin within. Petals minutely pubescent and whitish without, glabrous and pink within, the standard with a yellow spot above the claw; standard suborbicular (broader than

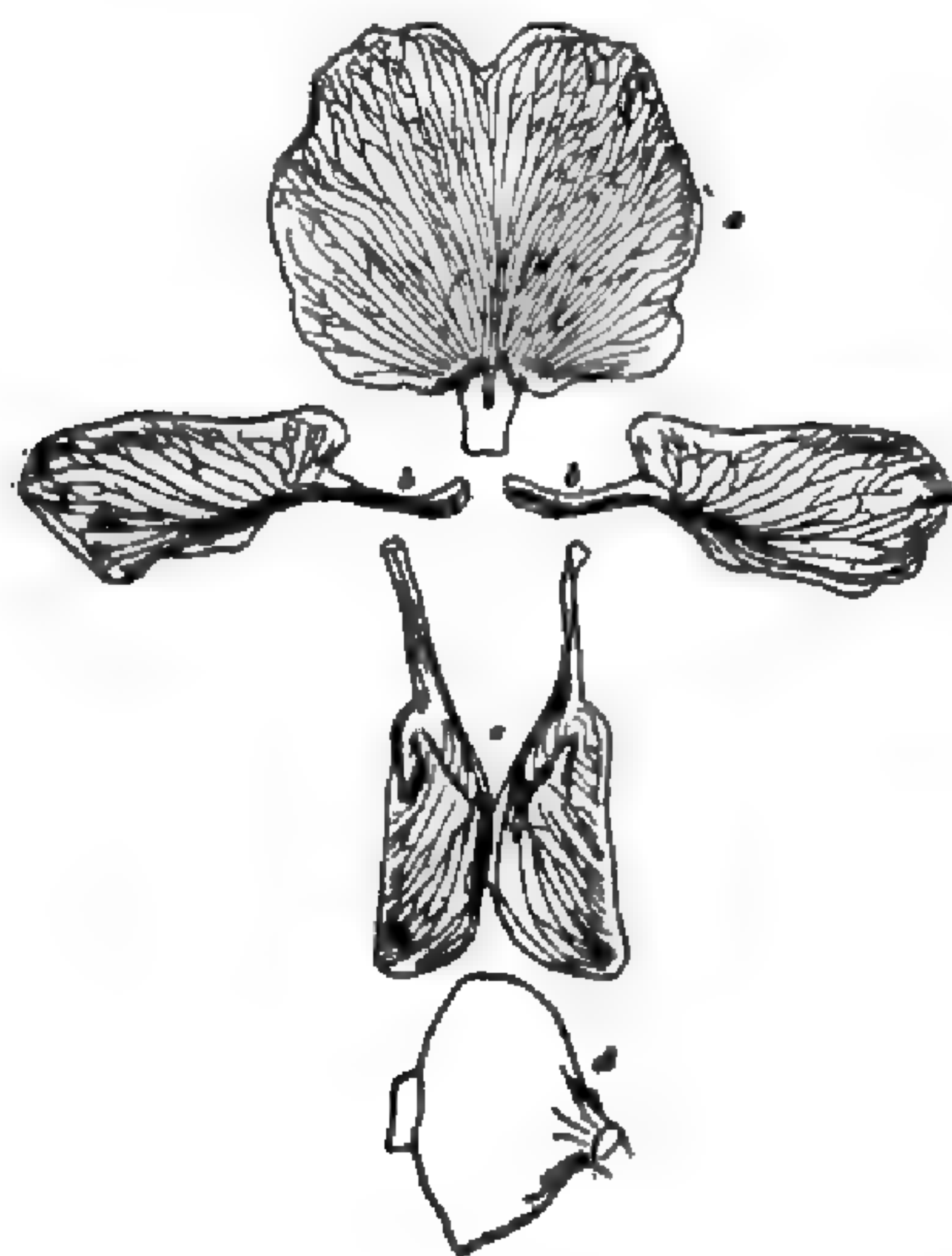


FIG. 11.—*Lonchocarpus proteranthus*.
a, Standard; b, wings; c, carinal petals; d, calyx. Natural size.
From R. S. Williams 418.

long), subpeltate, the claw thick, 2.5 to 3 mm. long, the blade 12 mm. long and 15 mm. broad, emarginate with a pair of beaklike appendages at the base, emarginate at the apex; wings oblique, auriculate, adhering to the carina by the base of the blades, the claw 4.7 mm. long, the blade rounded at the apex, 11 to 11.5 mm. long, 5.5 mm. broad; carinal petals falcate, adhering through the middle part of the lower margin of the blade, the claws slender, 5 to 5.5 mm. long, the blades subauriculate and convex at the base, obtuse at the apex, 9.5 mm. long, 4 to 4.5 mm. broad. Stamens monadelphous, the vexillar one free at the base for about 4 mm.; staminal tube broadened at the base, about 12 mm. long (including the free part of the stamens). Ovary linear, sessile, 10.5 mm. long, 5-ovulate, minutely silky-pubescent, the style glabrous, subapiculate, arcuate but not retrocurved, the stigma inconspicuous.

Legume lanceolate, thin, stipitate at the base, mucronate at the apex, glabrous, 1 or 2-seeded, 11 to 12 cm. long, up to 3 cm. broad, light brown, the ventral margin sulcate. Seeds reniform, flat, 2.7 cm. long, 1.6 cm. broad.

Type in the herbarium of the New York Botanical Garden, collected in the neighborhood of Penonomé, Province of Coclé, Panama, March, 1908, by R. S. Williams (no. 418).

This species evidently belongs to the *L. punctatus* group, but differs from the type in that the flowers precede the new leaves,¹ in the coriaceous, long-petiolulate leaflets, in the short floral racemes, in the distinct shape and dimensions of the petals, and probably also in the characters of the fruit.

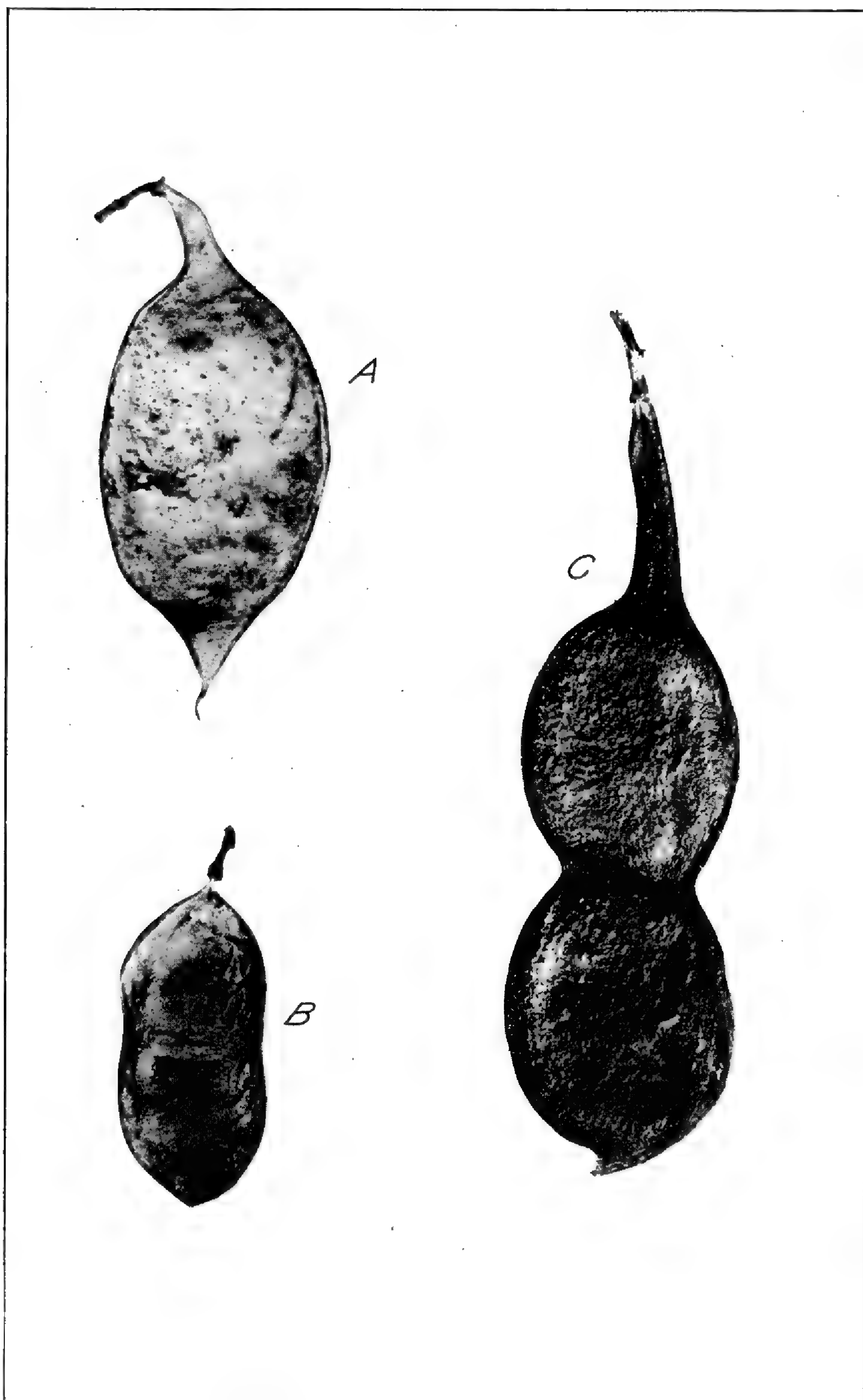
14. *Lonchocarpus luteomaculatus* Pittier, sp. nov. PLATE 4, B. FIGURE 12.

A small tree; branchlets and young shoots pubescent, the former covered with a dark gray, lenticellose bark.

Leaves 5 to 9-foliolate, the rachis minutely and sparsely pubescent, 8 to 12 cm. long. Leaflets coriaceous, the petiolules 6 to 7 mm. long, pubescent, the blades elliptic-ovate or obovate, usually cuneate at the base, subacuminate at the apex, 6 to 10 cm. long, 3 to 5.5 cm. broad, dark green and sparsely hairy above, subglaucous and sparsely hairy beneath; costa and primary veins yellowish, hairy, subimpressed above, prominent beneath; margins slightly revolute.

Racemes axillary or subfasciculate at the ends of the branchlets, the rachis pubescent, 9 to 10 cm. long. Peduncles and pedicels pubescent, the former solitary or geminate, usually biflorous, but also often uniflorous, in the latter case 2.5 mm., in the former case 1 mm. long; pedicels 1.5 mm. long; bracts and bractlets very small,

¹ This is true, however, of several other species belonging to distinct sections of the genus.



FRUITS OF (A) *LONCHOCARPUS CAUDATUS* PITTIER, (B) *L. LUTEOMACULATUS* PITTIER, AND (C) *L. COCHLEATUS* PITTIER.

ovate, obtuse, the latter distant from the calyx. Calyx salverform, short and broad (about 3 mm. long and 4 mm. broad), densely brownish-pubescent outside, the lobules shallow, the 2 anterior ones broadly rounded and coalescent, the 3 posterior acute with the middle one longer. Petals purple, the standard with a large ovate, yellow spot at the base; standard orbicular, truncate and slightly marginate at base, emarginate at apex, brownish silky pubescent without, the claw obliquely inserted, 1 to 1.5 mm. long, the blade 10 mm. long and broad; wings glabrous, the claw about 2.5 mm. long, the blade 7.5 to 8 mm. long, 3.5 mm. broad, slightly pubescent at the base, glabrous elsewhere, the claw 2.2 mm. long, the blade about 7.5 mm. long, 4 mm. broad. Vexillar stamen free at the base. Ovary linear, short-stipitate, 2-ovulate, about 8 mm. long, minutely silky-pubescent; style incurved, attenuate, about 3.5 mm. long, sparsely hairy, persistent; stigma capitellate.

Legume flat, coriaceous, 1 or 2-seeded, 4 to 4.5 cm. long, 1.5 to 2.2 cm. broad, glabrous, short-stipitate, the marginal nerve rounded and smooth.

Type in the U. S. National Herbarium, nos. 679271-2, collected along the Río Santa Isabel, Province of Colón, Panama, among bushes near the seashore, flowers and immature fruits, August 13, 1911, by H. Pittier (no. 4170).

Lonchocarpus luteomaculatus seems to stand alone among the *Epunctati*. It is characterized by the peculiar pubescence on the lower face of the leaflets, the prominent reticulation of the leaflets, the large yellow spot at the base of the standard, and the different shape of the legume.

15. *Lonchocarpus purpureus* Pittier, sp. nov.

FIGURE 13.

A tree, the young branchlets densely ferruginous-pubescent.

Leaves 9 or 11-foliolate, often opposite, the rachis obscurely canaliculate, 8 to 12 cm. long, fulvous-pubescent. Leaflets subcoriaceous, the petiolules subcanaliculate, 5 to 6 mm. long, fulvous-pubescent, the blades oblong or oblong-elliptic, rounded or subacute at the base, obtusely subacuminate at the apex, 3 to 7 cm. long, 1.5 to 2.5 cm. broad, glabrous or minutely puberulous above, hairy and strongly reticulate beneath, the costa and veins pubescent, immersed above, strongly prominent beneath.

Racemes axillary, the rachis fulvous-pubescent, 5 to 8 cm. long. Peduncles and pedicels densely ferruginous-hairy, the former usually biflorous, about 1 mm. long, the latter 2.5 to 3 mm. long; bracts and bractlets linear, small, ferruginous-hairy, the latter distant from the calyx. Calyx cupulate, broad, 5-toothed, about 3 mm. long, ferruginous-hairy without, the carinal tooth prominent. Petals purple; standard orbicular, concave, callous-plicate at the base, emarginate at the apex, densely ferruginous-pubescent without, the claw obliquely inserted, 1.3 mm. long, the blade 7.5 mm. long, 8 mm. broad, the margins more or less inflexed; wings oblong-elongate, rather narrow, oblique, auriculate, obtusely subacuminate, minutely



FIG. 13.—*Lonchocarpus purpureus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From J. D. Smith 3289.

yellow-spotted, glabrous, the claw 2 to 2.5 mm. long, the blade about 6 mm. long, 2 mm. broad; carinal petals falcate, rather broad, obtuse, minutely yellow-spotted, ferruginous-hairy along the lower margin, the claw 1.5 to 2 mm. long, the blade 5.5 to 6 mm. long, about 3 mm. broad. Staminal tube glabrous. Ovary linear, softly pubescent, about 5.5 mm. long, 4-ovulate; style arcuate, sparsely pubescent; stigma bilobulate, hairy.

Legume not known.



FIG. 12.—*Lonchocarpus luteomaculatus*. a, Standard; b, wings; c, carinal petals; d, stamens; e, pistil. Natural size. From Pittier 4170.

EXPLANATION OF PLATE 4.—Fruits of 3 species of *Lonchocarpus*. Fig. A, *L. caudatus*, from the type specimen, Nelson 1998; fig. B, *L. luteomaculatus*, from the type specimen, Pittier 4170; fig. C, *L. cochleatus*, from the type specimen, Langlassé 471. Natural size.

Type in the U. S. National Herbarium, no. 258406, collected at El Carrizal, Department of Santa Rosa, Guatemala, at an altitude of about 1,670 meters, in flower, May, 1892, by Heyde and Lux (J. D. Smith, no. 3289).

Determined as *Lonchocarpus sericeus* (Poir.) H. B. K. by the late Micheli, but evidently belonging to the subgenus *Eulonchocarpus*, and to be placed near *L. luteomaculatus*, from which it differs in the number and size of the leaflets, the shape of the branchlets, the dimensions of the floral parts, the yellow-spotted petals, etc.

16. *Lonchocarpus oaxacensis* Pittier, sp. nov.

FIGURE 14.

A tree, the branchlets grayish, lenticellate, at first tomentose.

Leaves 7-foliolate, the rachis brownish-tomentellous, terete, 6 to 8 cm. long. Leaflets subcoriaceous, the petiolules thick, 4 to 5 mm. long, tomentellous, the blades

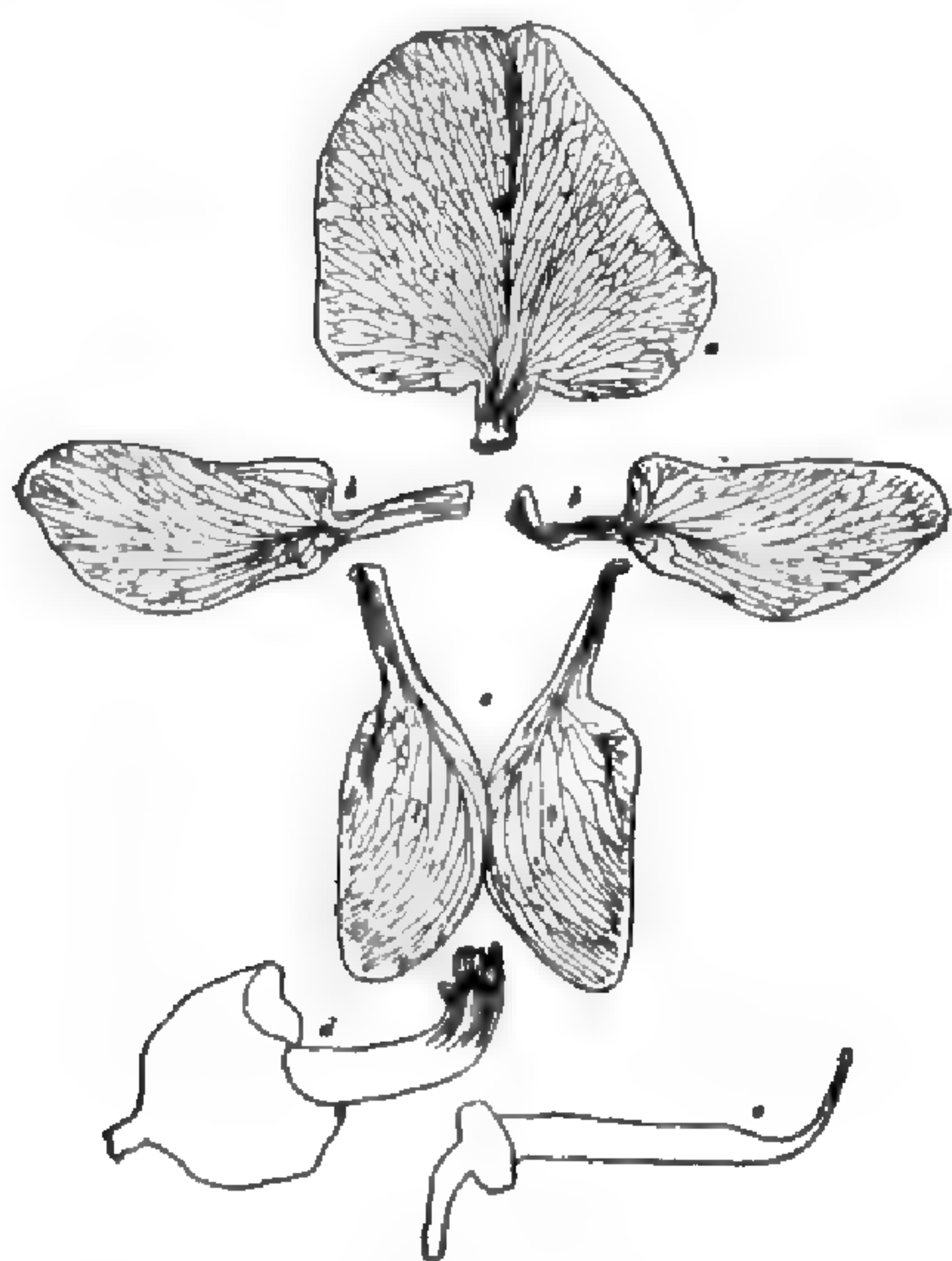


FIG. 14.—*Lonchocarpus oaxacensis*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From L. C. Smith 454.

ovate, rounded and subattenuate at the base, obtuse or subacute at the apex, 4.5 to 8 cm. long, 3 to 4.5 cm. broad, minutely pilosulous and dark green above, paler, pubescent, and reticulate beneath, the costa and veins subimpressed or prominulous above, prominent and fulvous-tomentellous beneath. Stipules not seen.

Racemes axillary and paniculate at the ends of the branchlets, the rachis puberulous-tomentellous, rather slender, 4 to 12 cm. long. Peduncles and pedicels tomentellous, the former biflorous, growing singly along the rachis, 6 to 7 mm. long, the latter 4 to 6 mm. long; bracts and bractlets linear or oblong, very small and fugacious, hairy, the latter not very close to the calyx. Calyx cupulate, obsoletely 5-toothed, minutely brown-pubescent, about 6 mm. long, the 2 carinal teeth rounded and subconate, the vexillar tooth broadly rounded. Petals whitish without, purplish turning to white toward the base within; standard orbicular, truncate at the base, emarginate at the apex, concave, pubescent

without, the claw about 2.5 mm. long, the blade 13 mm. long, 15 mm. broad; wings oblique, oblong, obtuse, auriculate, glabrous, ciliate at the apex, the claw about 5 mm. long, the blade 11.5 to 12 mm. long, 5.5 to 6 mm. broad; carinal petals falcate, subauriculate, obtuse, slightly pubescent at the apex, the claw as in the wings, the blade about 7.5 mm. long and 5.5 mm. broad. Vexillar stamen free at the base. Ovary sessile, linear, densely pubescent, about 9 mm. long, 7 or 8-ovulate; style arcuate, glabrous; stigma capitellate.

Legume not known.

Type in the U. S. National Herbarium, no. 371944, collected at Jayacatlán, State of Oaxaca, Mexico, at an altitude of about 1,500 meters, in flower, April 8, 1895, by Rev. Lucius C. Smith (no. 454).

A beautiful species, related probably to *Lonchocarpus latifolius* (Willd.) H. B. K. and conspicuous for its large flowers.

17. *Lonchocarpus lineatus* Pittier, sp. nov.

FIGURE 15.

A tree, the branchlets grayish, striate, minutely lenticellate, at first ferruginous-hairy.

Leaves (1 to) 5-foliolate, the rachis canaliculate, grayish-hairy, 1.5 to 7.5 cm. long. Leaflets submembranous, the petiolules terete, densely grayish-hairy, 4 to 6 mm. long, the blades ovate, broadly rounded at the base, obtusely acuminate at the apex, 4 to 12 cm. long, 2.5 to 5 cm. broad, puberulous or glabrescent above, softly grayish-pubescent beneath, the costa and veins grayish-hairy and impressed above, ferruginous-hairy and prominent beneath.

Racemes few, axillary or terminal, subsessile, the rachis ferruginous-pubescent, 4 cm. long or longer. Peduncles and pedicels ferruginous-hairy, the former biflorous, not over 1.5 mm. long, the latter 2 to 3 mm. long; bracts and bractlets very small, ovate, hairy, the latter opposite, inserted near the upper end of the pedicels. Calyx cupulate, truncate or slightly 5-toothed, 2.5 to 3 mm. long, minutely ferruginous-pubescent without, reddish-lineolate. Petals pink, marked with darker lines following the veins; standard suborbicular, flat, 2-lobulate and callous-plicate at the base, emarginate at the apex, sparsely silky-pubescent without, the claw 1.5 mm. long, the blade about 9.5 mm. long, 11 to 11.5 mm. broad; wings oblong, auriculate, broadly obtuse, sparsely pilosulous without, the claw about 3 mm. long, the blade 8.5 mm. long, 3.5 mm. broad; carinal petals oblique, obovate, subfalcate, calcarate at the base of the blade, broadly obtuse, sparsely hairy without and ciliate at the apex, the claw as in the wings, the blade 6.5 to 7 mm. long, 3 to 3.5 mm. broad. Staminal tube glabrous. Ovary linear, grayish-pubescent, about 7 mm. long, 8-ovulate; style glabrous, arcuate; stigma conspicuously bilobulate.

Legume not known.

Type in the John Donnell Smith Herbarium, collected at Cubilquitz, Alta Verapaz, Guatemala, at an altitude of 350 meters, in flower, April, 1901, by H. von Türckheim (J. D. Smith, no. 7853).

Near *Lonchocarpus oaxacensis*, with which it has in common the relatively long, 7 or 8-ovulate ovary and the pubescent leaflets, but from which it differs in the smaller number of the leaflets, in the pink, lineolate petals, and in the peculiar conformation of the base of the blade in the carinal petals.

18. *Lonchocarpus unifoliolatus* Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 90. 1860.

FIGURE 16.

A small tree, the branchlets reddish brown, glabrous.

Leaves unifoliolate, glabrous; petiolules slender, subcanaliculate, thicker and dark-colored at base and apex, 1.3 to 3.5 cm. long; leaflets ovate, rounded at the base, with a long and narrow obtuse acumens at the apex, 10 to 12.5 cm. long, 3.5 to 7 cm. broad, coriaceous, dark green above, paler and reticulate beneath, the costa and veins prominent. Stipules not seen.

Racemes axillary, the rachis sparsely pilosulous, 12 to 15 cm. long. Peduncles and pedicels grayish-pubescent, the former 1 to 2 mm. long, usually geminate and biflorous, the latter 2 to 2.5 mm. long; bracts and bractlets ovate-oblong, grayish-pilosulous, the latter in a pair close to the calyx. Calyx cupulate, grayish-pubescent without, broad, about 2 mm. long, distinctly denticulate, the carinal tooth more prominent. Petals pinkish; standard ovate, flat, callous-plicate but not lobulate at the base, slightly emarginate, pubescent without, the claw 1.8 mm. long, the blade about 9 mm. long and 6 mm. broad; wings adhering to the keel, oblique, oblong, rounded-auriculate, sparsely pubescent at the apex, the claw 2.5 to 3 mm. long, the blade 7 to 7.5 mm. long, 2 mm. broad; carinal petals falcate, pubescent at the apex, the claw 2.5 to 3 mm. long, the blade

about 6.5 mm. long and 2.5 mm. broad. Staminal tube broadly dilated, the vexillar stamen free at the base. Ovary linear, stipitate and contracted above the base,



FIG. 15.—*Lonchocarpus lineatus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From J. D. Smith 7853.

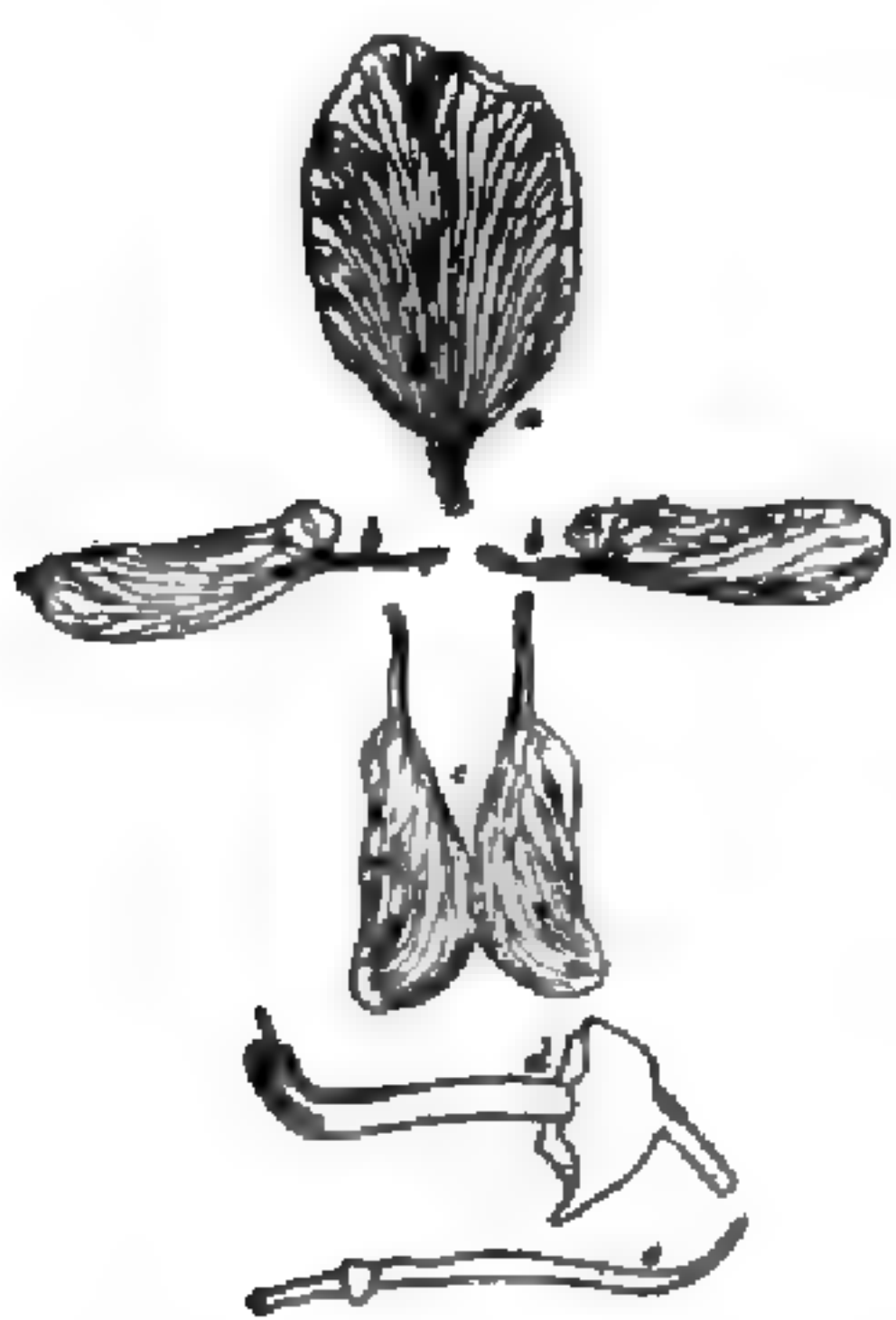


FIG. 16.—*Lonchocarpus unifoliolatus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Galeotti 3457.

gray-pubescent, about 6 mm. long, 3-ovulate; style arcuate, pubescent at the base; stigma inconspicuous.

Legume not known.

Type collected in southern Mexico by Jurgensen (no. 717).

The above description is based on a specimen in the U. S. National Herbarium, collected at Chinantla, State of Puebla, Mexico, in flower, July, 1849, by H. Galeotti (no. 3457).

This very curious species is readily distinguished by its unifoliate leaves. The so-called petiolule is composed of a rudimentary rachis on which the real petiolule, about 6 mm. long, is articulated as in those species with the normal type of leaves.

19. *Lonchocarpus cochleatus* Pittier, sp. nov. PLATE 4, C (facing p. 65).

A tree 4 to 5 meters high, the branchlets grayish, glabrous, minutely lenticellate.

Leaves 7 or 9-foliate, glabrous, the rachis slender, canaliculate, 7.5 to 12 cm. long. Leaflets coriaceous, the petiolules canaliculate, slender, 7 to 8 mm. long, the blades ovate, rounded and subattenuate at the base, obtuse or obtusely subacuminate at the apex, 4 to 9.5 cm. long, 2.5 to 4.5 cm. broad, light green on both faces, the costa and veins impressed above, the former strongly, the latter scarcely prominent beneath.

Flowers not known.

Legume lanceolate or elongate, oblique, attenuate-stipitate at the base, rostrate on the carinal side at the apex, light brown with darker margins, glabrous, 1 to 3-seeded, when 1-seeded ovate, about 4.5 cm. long and 2.7 cm. broad, subcochleate or shallowly concavo-convex, when more than 1-seeded more or less arcuate, up to 13 cm. long, constricted between the seeds, the joints cochleate. Seeds, in specimen, immature.

Type in the U. S. National Herbarium, no. 385594, collected at El Cabazal, State of Guerrero, Mexico, with immature fruits, October 18, 1898, by E. Langlassé (no. 471).

Distributed as *Lonchocarpus violaceus* (Poir.) H. B. K., but quite distinct and not identifiable with any of the Central American species. Unfortunately the flowers are wanting and the seeds undeveloped. It seems to be nearest *L. megalanthus* Pittier, but the rachis of the leaves is canaliculate, the leaflets are more numerous with the veins nearer and at a different angle, etc. The fruits of the latter species are not known.

20. *Lonchocarpus caudatus* Pittier, sp. nov. PLATE 4, A (facing p. 65).

A tree, the branchlets brownish, glabrous, minutely lenticellate.

Leaves 5-foliate, the rachis slightly canaliculate, glabrescent, 10 to 12 cm. long. Leaflets coriaceous, the petiolules slightly canaliculate, glabrescent, 9 to 10 mm. long, the blades ovate, rounded and subattenuate at the base, long-acuminate at the apex with a narrow and acute acumen, 6.5 to 12.5 cm. long, 3.5 to 6 cm. broad, glabrous, the costa and nerves hardly prominent above, glabrescent, subreticulate, the costa and veins prominent beneath. Stipules not seen.

Flowers not known.

Fruiting racemes axillary, the rachis glabrous or glabrescent, 18 cm. long. Peduncles and pedicels glabrous or softly pubescent, the former about 4 mm. long, the latter about 5 mm. long; bracts and bractlets not seen.

Legume flattened club-shaped or lanceolate, stipitate, apiculate (i. e., bearing the persistent style), glabrous, coriaceous, 1 or 2-seeded, 6 or 10 cm. long, 3 cm. broad, the margin thin-edged (the carinal margin slightly broader). Seeds reniform, brown with white hilum, 10 mm. long, 6 mm. broad, about 1.5 mm. thick.

Type in the U. S. National Herbarium, no. 48925, collected between Petlancingo and Acatlán, State of Puebla, Mexico, November 20, 1894, in fruit, by E. W. Nelson (no. 1998).

The long-acuminate leaflets, broader near the base, distinguish this species from *Lonchocarpus mexicanus* and *L. megalanthus*, to which it is probably closely related. To judge by the remnants of the indument on the leaves, these must be densely tomentose in the first stages of growth, as in the species of the section *Eriophylli*.

21. *Lonchocarpus latifolius* (Willd.) H. B. K. Nov. Gen. & Sp. 6: 383. 1823.

FIGURE 17.

Amerimnum latifolium Willd. Sp. Pl. 3: 909. 1801.

A large tree, 10 meters high and over, the branchlets thick, the bark brownish gray, covered with brown lenticels.

Leaves 5 to 9-foliolate, often opposite, the rachis terete or canaliculate, glabrous, 16 to 22 cm. long. Leaflets large, coriaceous, the petiolules thick, canaliculate, 8 to 10 mm. long, dark-colored, glabrous or at first pubescent, the blades ovate or ovate-oblong, more or less oblique, more or less broadly cuneate-attenuate at the base, short-acuminate and subemarginate at the apex, 8.5 to 23 cm. long, 4.5 to 11 cm. broad, dark green above, paler beneath, the costa and veins prominent. Stipules not seen.

Racemes solitary in the axils of the upper leaves, the rachis glabrous, thick, 5 to 12 cm. long. Peduncles and pedicels minutely pubescent, the former very short (less than 1 mm. long), 1 or 2-flowered, the latter (when present) 2.5 to 3 mm. long; bracts oblong, about 1 mm. long, pubescent; bractlets minute, pubescent, linear. Calyx broadly cupulate, subattenuate at the base, about 3 mm. long, minutely pubescent, distinctly 5-dentate. Petals greenish purple or reddish; standard orbicular, truncate at the base, slightly emarginate at the apex, minutely pubescent without, the claw 1.5 mm. long, the blade slightly callous at the base, 5.5 to 6 mm. long, 8 to 8.5 mm. broad; wings oblong, obtuse, auriculate and plicate on the vexillar side, adhering to the keel, sparsely and minutely pubescent without, the claw 2.3 mm. long, the blade 5.5 mm. long, 2.5 mm. broad; carinal petals adhering, falcate, obtuse, slightly pubescent without, the claw 2.1 or 2.2 mm. long, the blade about 4 mm. long and 2.5 mm. broad. Vexillar stamen free at the base. Ovary sessile, linear, minutely pubescent, attenuate at the apex, about 5 mm. long, 2 to 5-ovulate; style arcuate, pubescent at the base; stigma capitellate.

Legume lanceolate, subsessile, attenuate at both ends, shortly mucronate or obtuse at the apex, submembranous, glabrous, 4.5 to 6.5 cm. long, 1.8 to 2.4 cm. broad, 1 to 5-seeded, the margins thin-edged. Seeds reniform, very thin, about 11 mm. long and 6 mm. broad.

Type from the West Indies.

The following Central American specimens have been examined, the description being based upon those from Panama.

PANAMA: Coiba Island, Pacific coast of Veraguas, in fruit, *Seemann* 627. Bismarck above Penonomé, Province of Coclé, in flower, March 5, 1908, *Williams* 317. Río Indio de Fató, Province of Colón, near sea level, in fruit, August 24, 1911, *Pittier* 4269.

GUATEMALA: Baja Verapaz or Chiquimula, in flower, 1885, *Watson* 463.

HONDURAS: Island of Ruatán, along the Caribbean Main, in flower, 1885, *Gaumer* 2025.

In this species the leaves are often opposite, and this together with the thin legumes, wrinkled above the flat seed, somewhat reminds one of the genus *Platymiscium*. The leaflets are very variable in size and shape.

22. *Lonchocarpus darienensis* Pittier, sp. nov.

FIGURE 18.

A small tree 3 to 4 meters high, the trunk 5 to 6 cm. in diameter, sparsely branched; bark gray, with white lenticels; young shoots more or less pubescent.

Leaves 7 or 9-foliolate, entirely glabrous, the rachis terete, 10 to 16 cm. long. Petiolules terete, 7 mm. long. Leaflet blades oblique, ovate to elliptic, rounded or

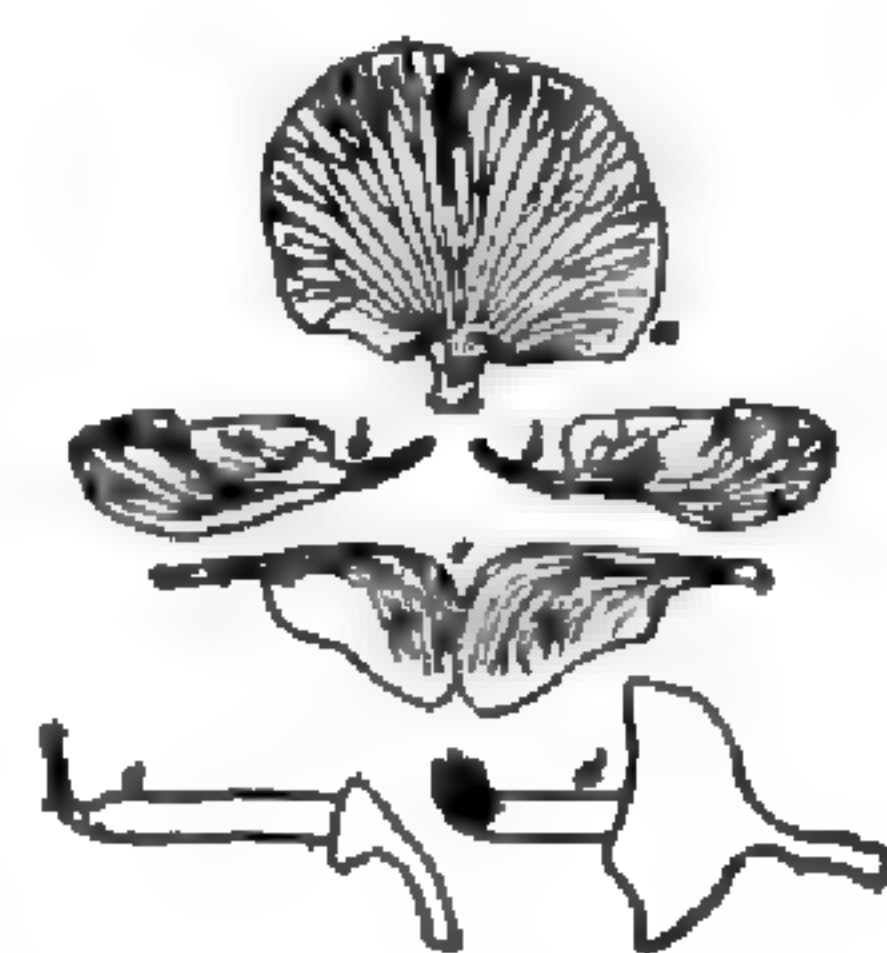


FIG. 17.—*Lonchocarpus latifolius*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From *R. S. Williams* 317.

cuneate at the base, obtusely acuminate at the apex, 5.5 to 11 cm. long, 3 to 5 cm. broad; nervation impressed above, slightly prominent beneath. Stipules not seen.

Racemes axillary or terminal, sometimes geminate, the rachis pubescent, 3 to 11 cm. long. Peduncles and pedicels pubescent, the former either biflorous, then hardly

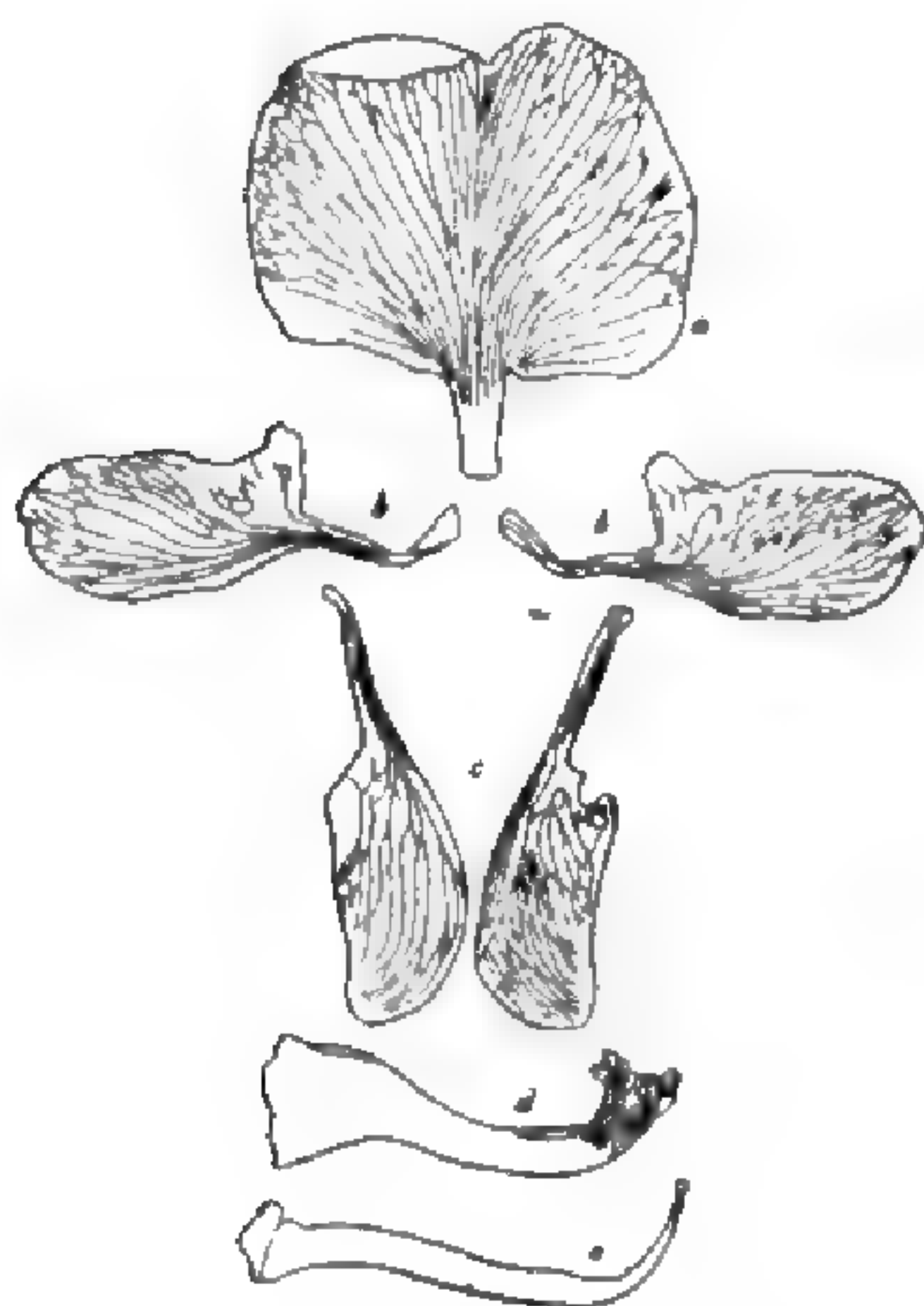


FIG. 18.—*Lonchocarpus darriensis*. a, Standard; b, wings; c, carinal petals; d, stamens; e, pistil. Natural size. From Pittier 5515.

over 1 mm. long, or uniflorous and about 4 mm. long, the pedicels also about 4 mm. long bracts and bractlets very small, ovate or suborbicular, pubescent, the latter opposite and inserted at the joint of the pedicel and calyx stipe. Calyx broadly salverform, short-stipitate, gray-pubescent, about 5 mm. long, 5-toothed, the 2 anterior teeth coalescent and obsolete. Petals lavender-colored at the apex, gradually shading to white toward the claw, minutely yellow-spotted; standard suborbicular, truncate at the base, emarginate at the apex, the claw slightly oblique, 3 mm. long, the blade about 10 mm. long and 12.5 mm. broad, minutely pubescent without; wings oblong, oblique, prominently auriculate, obtuse, slightly pubescent without, the claw 5.5 mm. long, the blade about 8 mm. long and 4 mm. broad; carinal petals obovate, obtuse, densely pubescent without along the keel, the claw 5 mm. long, the blade about 17.5 mm. long and 4 mm. broad. Vexillar stamen free at the base. Ovary linear, densely whitish-pubescent, about 10.5 mm. long, 5-ovulate; style

arcuate, subglabrous; stigma capitellate.

Type in the U. S. National Herbarium, no. 715766, collected near Garachiné, southern Darién, Panama, in light woods, in flower, January 28, 1912, by H. Pittier (no. 5515).

In the absence of the legume I place this species tentatively near *Lonchocarpus megalanthus* and *L. mexicanus*, with both of which it seems to have close affinities.

23. *Lonchocarpus megalanthus* Pittier, sp. nov.

FIGURE 19.

A deciduous tree about 10 meters high, low-branched, the branchlets brownish, glabrous, lenticellate.

Leaves 5 or 7-foliolate, glabrous, the rachis terete, 5 to 9 cm. long. Leaflets coriaceous, light green, the petiolules narrowly canaliculate, 1 cm. long, the blades ovate or ovate-oblong, rounded and subattenuate at the base, obtuse or very shortly obtuse-acuminate at the apex, reticulate, 3.5 to 9 cm. long, 2.5 to 4 cm. broad, the costa and veins impressed above, slightly prominent beneath. Stipules not seen.

Racemes growing from nodes on leafless branchlets, densely flowered, glabrous, the rachis stout, 2.5 to 6 cm. long. Peduncles and pedicels minutely pubescent, the former very short (1 mm. long or less), usually biflorous, the latter slender, 3 to 4 mm. long; bracts and bractlets very small and deciduous, ovate-orbicular, pubescent, the latter opposite and close to the base of the calyx. Calyx large, cupulate, truncate or slightly 5-dentate, minutely pubescent without, about 6 mm.

long. Petals unusually large, pubescent without; standard suborbicular, truncate and callousplicate at the base, emarginate at the apex, lilac within with a large greenish

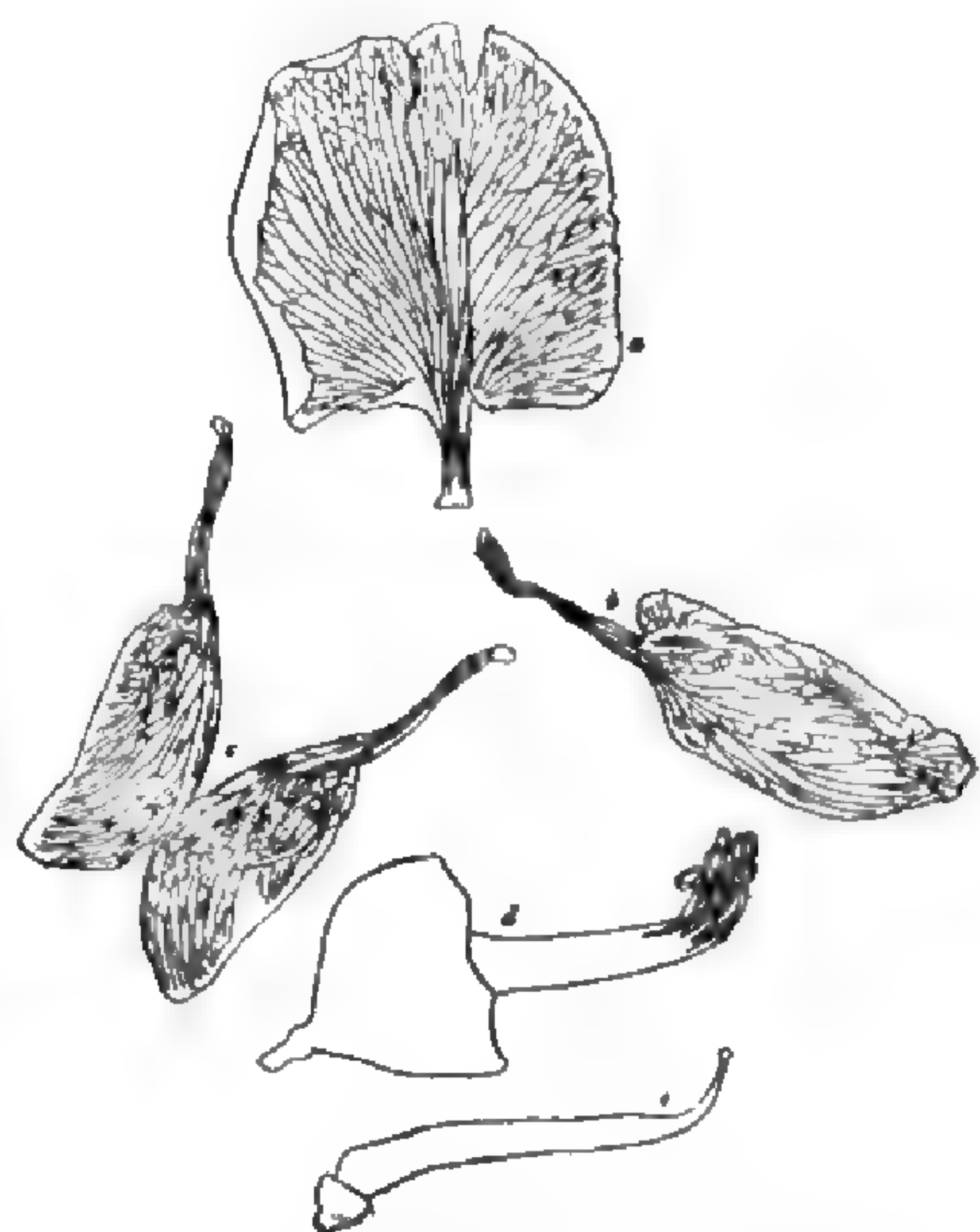


FIG. 19.—*Lonchocarpus megalanthus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Palmer 1997.

yellow patch at the base, the claw slender, 4.5 mm. long, the blade 13.5 to 14 mm. long and broad; wings and keel whitish on the lower half, purple above. Wings oblong, auriculate, obtuse, the claw 7 mm. long, the blade 13 mm. long, about 5.5 mm. broad; carinal petals subfalcate, obtuse, scarcely auriculate on the vexillar side, the claw as in the wings, the blade about 10.5 mm. long, 5 mm. broad. Vexillar stamen free at the base; anthers ovate, large. Ovary linear, stipitate, densely and minutely pubescent, about 10.5 mm. long, 4 or 5-ovulate; style slightly arcuate, pubescent at the base; stigma capitellate.

Legume not known.

Type in the U. S. National Herbarium, no. 305321, collected in a canyon in the vicinity of Tepic, Mexico, in flower, January, 1892, by Edward Palmer (no. 1997).

This species, closely related to *Lonchocarpus mexicanus*, is distinguished by having the largest flowers among the Middle American representatives of the genus.

24. *Lonchocarpus mexicanus* Pittier, sp. nov.

FIGURE 20.

A tree, the branchlets gray, sparsely lenticellate, glabrous.

Leaves 7-foliolate, glabrous, the rachis subcanaliculate, 9 to 11 cm. long. Leaflets large, coriaceous, the petiolules thick, narrowly canaliculate, 5 to 7 mm. long, the blades ovate, broadly rounded at the base, broadly obtuse-acuminate at the apex, 6 to 11 cm. long, 3 to 6 cm. broad, light green above, paler beneath, the costa and veins impressed on the upper face, prominent beneath. Stipules not seen.

Racemes solitary in the axils of the upper leaves, the rachis angulate, minutely pubescent, 6 to 11 cm. long. Peduncles and pedicels white-tomentellous, the former biflorous, 2 to 3 mm. long, the latter about 3 mm. long; bracts and bractlets scarious, ovate, pubescent without, very caducous, the latter inserted on the upper half of the pedicel, not close to the calyx. Calyx cupulate, 5-lobulate in the bud, truncate in the flower, about 5.5 mm. long, silvery-pubescent without. Petals purplish, more or less yellow-dotted; standard orbicular or subquadrangular, concave, slightly plicate at the base, emarginate at the apex, densely tomentellous without, the claw 2.5 to 3 mm. long, the blade 12 mm. long, about 14 mm. broad; wings adhering to the keel, oblong, auriculate, obtuse, glabrous, the claw 4.5 to 5 mm. long, the blade 10 mm. long and 4.5 mm. broad; carinal petals falcate, subauriculate, obtuse, silky-pubescent without at the apex and along the carinal margin, the claw as in the wings, the blade 7.5 mm. long, 3.5 to 4 mm. broad. Vexillar stamen free at the base. Ovary linear, attenuate into the style, silvery-pubescent, about 6.5 mm. long, 6-ovulate; style long and slightly arcuate, pubescent at the base; stigma capitellate.

Legume not known.

Type in the U. S. National Herbarium, no. 48923, collected at San Andrés Tuxtla, State of Veracruz, Mexico, at an altitude of about 500 meters, in flower, May 7, 1894, by E. W. Nelson (no. 455).

25. *Lonchocarpus minimiflorus* Donn. Smith, Bot. Gaz. 44: 110. 1907.

FIGURE 21.

A tree 8 to 10 meters high, the branchlets brownish, minutely lenticellate, at first grayish-pubescent.

Leaves 7 to 13-foliolate, the rachis slender, canaliculate, angulate, pubescent, 4 to 10 cm. long. Leaflets submembranous, the petiolules canaliculate, hairy, 3 to 5 mm. long, the blades ovate to elliptic-lanceolate, rounded or cuneate at the base, obtuse

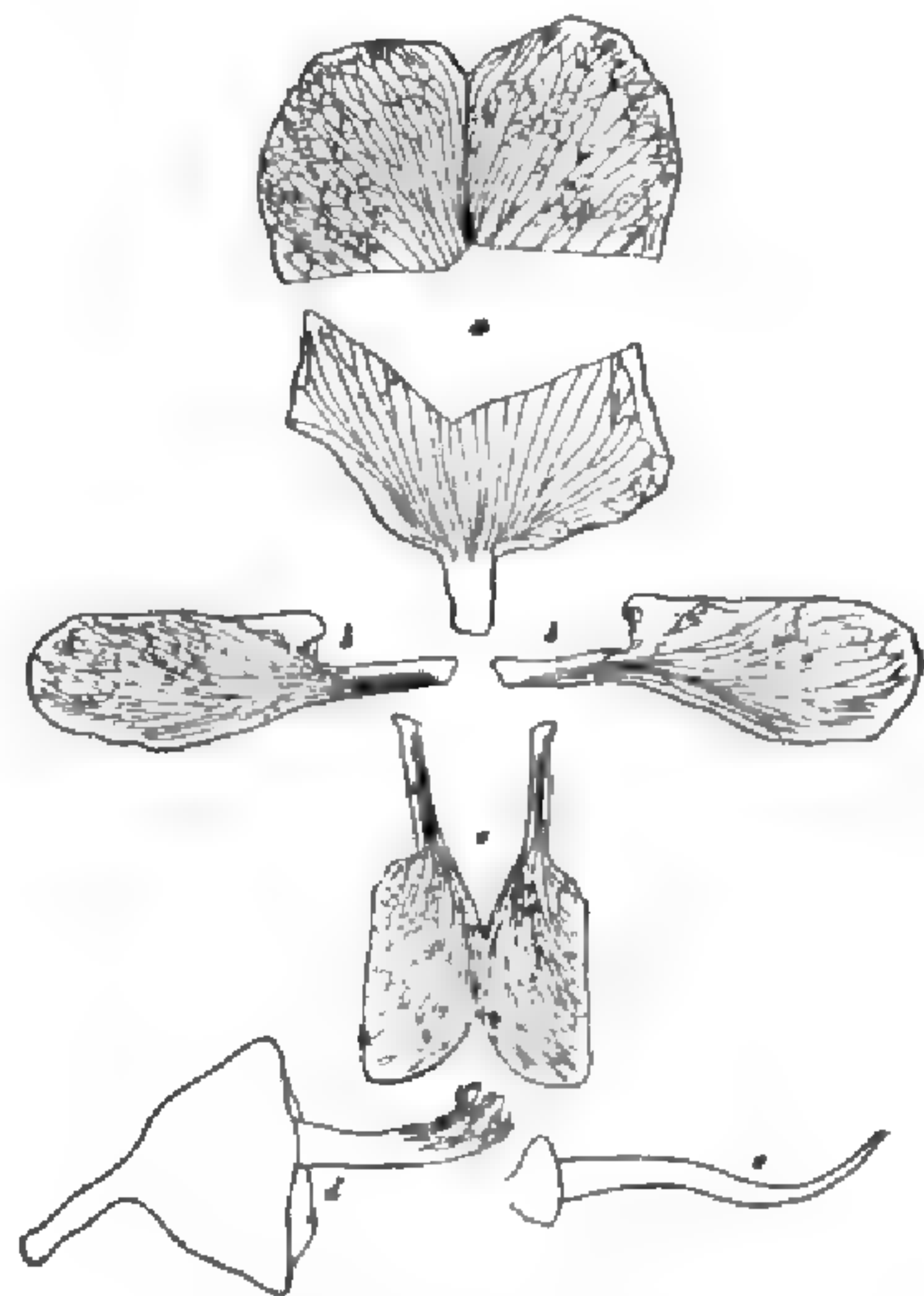


FIG. 20. *Lonchocarpus mexicanus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Nelson 455.

or subacute at the apex, 2 to 7 cm. long, 1 to 3.5 cm. broad, the lateral ones more or less oblique, minutely pubescent along the costa and veins above, beneath minutely reticulate and pubescent, the costa and veins prominulous. Stipules small, ovate, pubescent, caducous.

Racemes axillary, congested, sometimes 2-branched, almost drooping, the rachis 4-angulate, pubescent, 7 cm. long or less. Peduncles and pedicels pubescent, the former mostly biflorous, 1 mm. long or less, the latter of the same length or little longer; bracts



FIG. 21.—*Lonchocarpus minimiflorus*. a, Standard; b, wings; c, carinal petals. Natural size. From J. D. Smith 6330.

and bractlets ovate, pubescent, the latter opposite and close to the calyx. Calyx cupulate, subtruncate, fulvous-pubescent, about 2 mm. long. Petals purple; standard oblique, orbicular, concave, subcallous and subemarginate at the base, broadly emarginate at the apex, densely silky-pubescent without, the claw about 1 mm. long, the blade 4 to 4.5 mm. long, 4 mm. broad; wings adhering to the keel, rounded-auriculate, rounded-obtuse, glabrous, the claw about 1.8 mm. long, the blade about 3.5 mm. long, 1.3 to 1.4 mm. broad; carinal petals often free from each other, subfalcate, auriculate, obtuse, glabrous, the claw 3.9 mm. long, the blade 3 mm. long, 1.7 mm. broad. Vexillar stamen free at the base. Ovary linear, pubescent, about 3.5 mm. long, 4 to 6-ovulate; style strongly arcuate.

Legume not known.

The type, in the John Donnell Smith Herbarium, was collected at Santa Bárbara, Department of Sololá, Guatemala, at an altitude of about 450 meters, in flower, January, 1894, by Heyde and Lux (J. D. Smith, no. 6330).

Another specimen referred to this species was collected between Jalisco and Aurora, State of Chiapas, Mexico, by G. N. Collins and C. B. Doyle.

This species has close affinities with *L. atropurpureus* Benth., but differs in the pubescence, the size of the flowers, the auriculate carinal petals, etc.

26. *Lonchocarpus atropurpureus* Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 91. 1860.

PLATE 5, B. FIGURE 22.

A tree 3 to 8 meters high, the branchlets grayish, glabrous, minutely lenticellate.

Leaves 5 to 9-foliolate, the rachis slender, glabrous, 3 to 7.5 cm. long. Leaflets submembranous, the petiolules canaliculate, 2 to 3 mm. long, glabrous or glabrescent, the blades ovate-oblong or sublanceolate, more or less rounded or cuneate at the base, obtuse or shortly obtuse-acuminate at the apex, 2 to 6.5 cm. long, 1 to 3 cm. broad, dark green above, paler, minutely reticulate, and more or less pilosulous beneath, the costa and veins prominulous on the upper face, prominent on the lower one. Stipules ovate, pubescent, small and caducous.

Spikes axillary or paniculate at the ends of the branchlets, the rachis more or less pubescent, 1.5 to 7.5 cm. long. Peduncles and pedicels slender, pubescent, the former simple or biflorous, 2 to 3 mm. long, the latter about 1 mm. long; bracts and bractlets oblong, pubescent, the latter very small, opposite, appressed to the calyx. Calyx broadly cupulate, minutely pubescent without, about 2 mm. long, at first distinctly 5-toothed, later subtruncate. Petals dark pinkish purple; standard suborbicular, concave, sublobulate and slightly callous at the base, deeply and broadly emarginate and slightly pubescent on the back at the apex, the claw about 0.8 mm. long, the blade 8.5 mm. long, nearly 10 mm. broad, the lateral margins inflexed; wings adhering to the keel, oblong, auriculate, rounded-obtuse at the apex, glabrous, the claw 2.2 mm. long, the blade 7.5 mm. long, 3.2 mm. broad; carinal petals broadly obtuse and sparsely pubescent at the apex, the claw about 2.5 mm. long, the blade 5.5 mm. long, 3 mm. broad. Vexillar stamen free at the base. Ovary stipitate, linear, minutely pubescent, about 5.5 mm. long, 5 or 6-ovulate; style strongly arcuate (retrocurved); stigma capitellate.

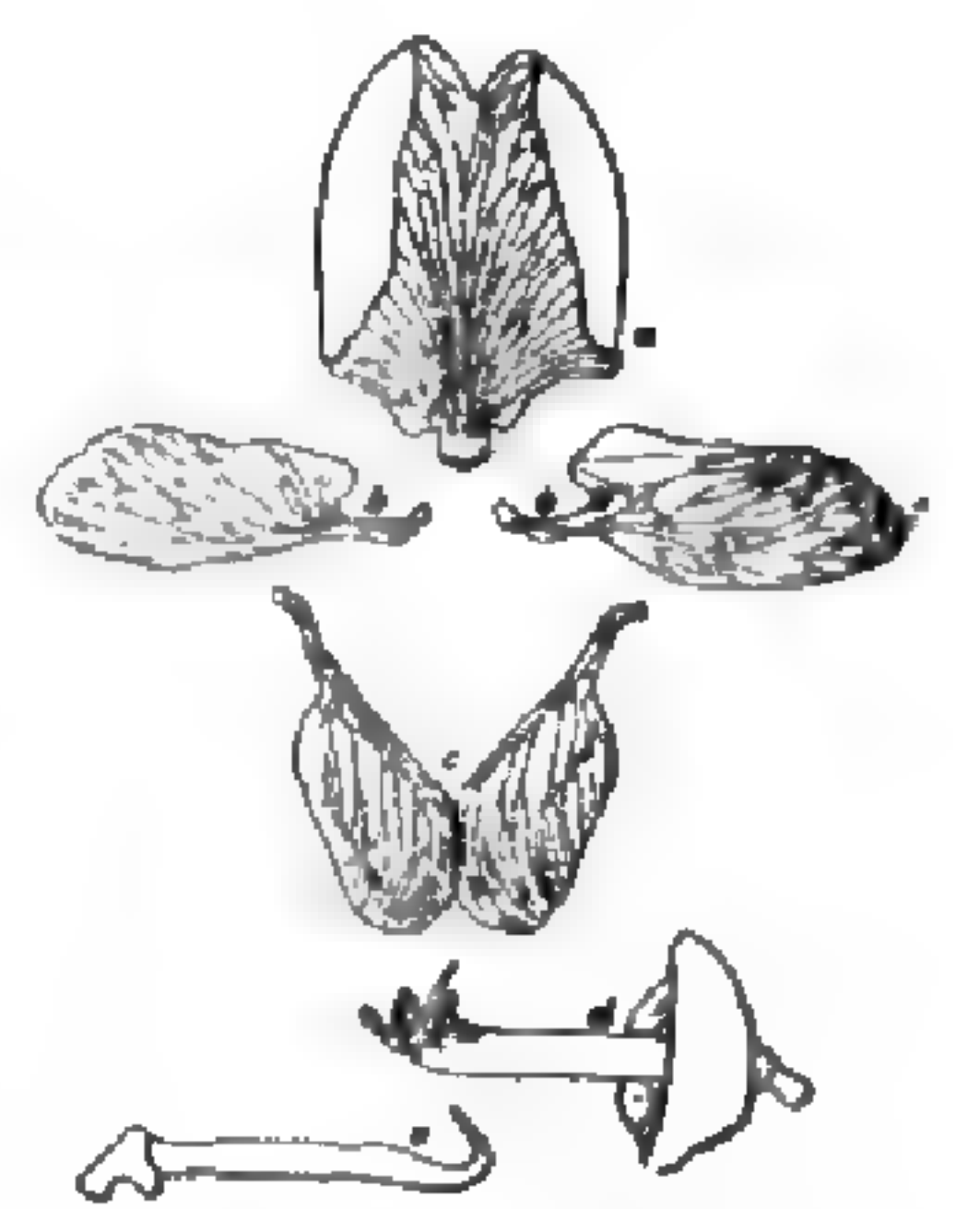
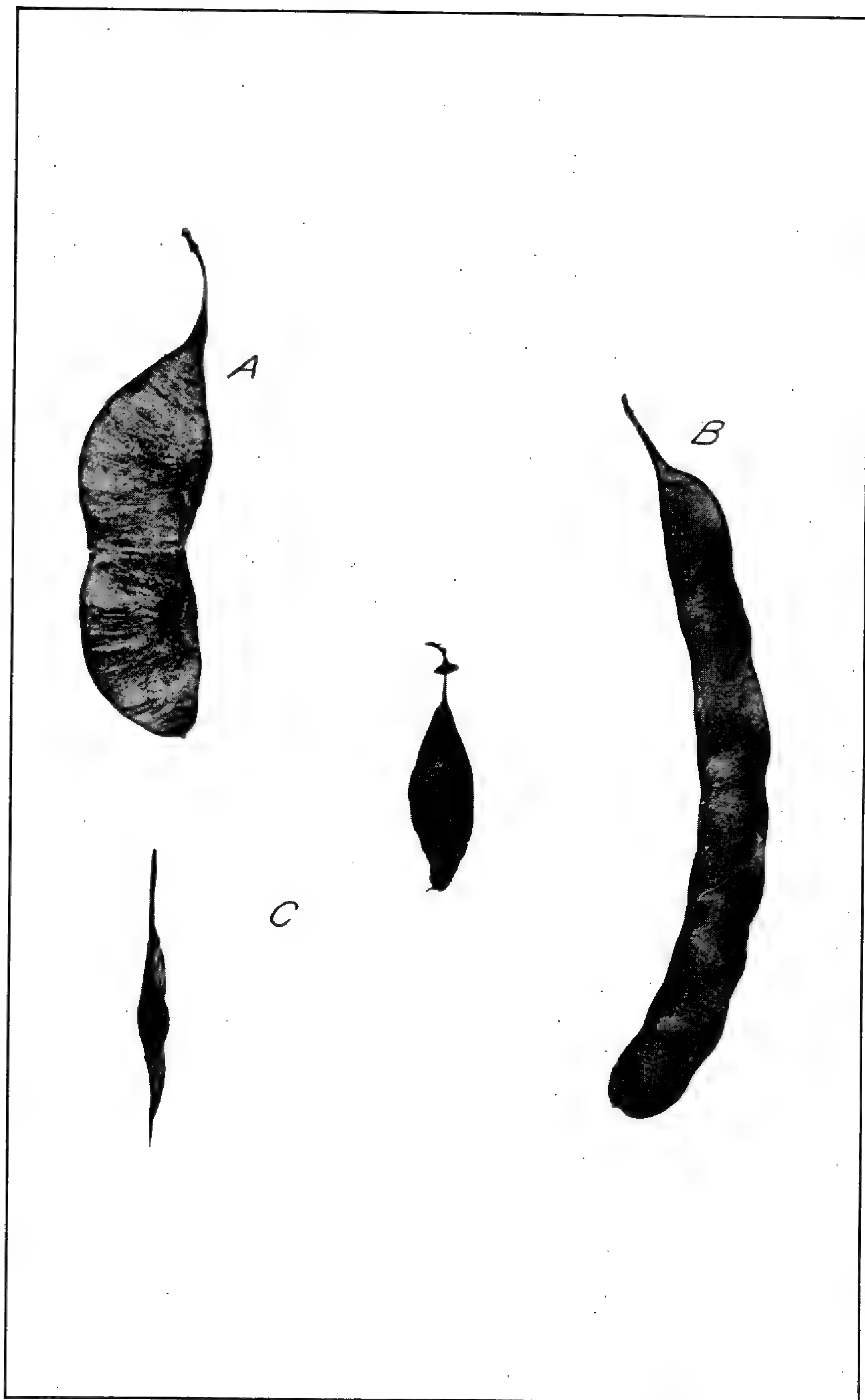


FIG. 22.—*Lonchocarpus atropurpureus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Deam 6367.



FRUITS OF (A) *Lonchocarpus orotinus* Pittier, (B) *L. atropurpureus* Benth.,
AND (C) *L. lanceolatus* Benth.

Legume long and slender stipitate, narrow, thin, rounded and mucronate at the apex, thin-edged on the carinal margin, glabrous, 4 to 10 cm. long, 0.9 to 1 cm. broad, 1 to 4-seeded. Mature seeds not seen.

Type from Mexico. The above description is drawn from specimens collected near Bonda, at the foot of the Cordillera de Santa Marta, Colombia, October 23, 1898, by H. H. Smith (no. 22).

ADDITIONAL SPECIMENS EXAMINED:

VENEZUELA: Quebrada del Tigre, near Arenales, State of Lara, alt. about 400 meters, in flower, September 6, 1910, *Jahn* 187.

ECUADOR: El Recreo, Province of Manabí, flowers and young fruits, *Eggers* 15766.

GUATEMALA: Gualán, Department of Zacapa, in flower, June 20, 1909, *Deam* 6367.

Reported also by earlier collectors from Santa Marta, Colombia, and from Maracaibo and the Andes of Trujillo and Mérida, Venezuela.

The identification of the Guatemalan specimens is doubtful. The racemes are sparsely flowered and the rudimentary fruits very short, broad, and pubescent.

27. *Lonchocarpus lanceolatus* Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 92. 1860. PLATE 5, C. FIGURE 23.

A shrub or small tree, the branchlets flexuous, gray or brownish, lenticellate, the younger parts hairy.

Leaves 9 to 15-foliolate, the rachis slender, canaliculate, hairy, 4.5 to 9.5 cm. long. Leaflets small, submembranous, the petiolules hairy, canaliculate, 2 to 3 mm. long, the blades ovate-lanceolate or oblong-lanceolate, rounded or cuneate at the base, shortly obtuse-acuminate at the apex, 2 to 4 cm. long, 0.8 to 1.8 cm. broad, dark green and sparsely pubescent above, paler and more densely pubescent beneath, the costa and veins conspicuous on the upper surface but not slightly prominent as on the lower surface. Stipules small, ovate, hairy, caducous.

Racemes solitary or sometimes one large with 1 or 2 small ones in the axils of the leaves, the rachis pubescent, 2 to 4 cm., rarely only 1 cm. long. Peduncles and pedicels minutely pubescent, the former usually biflorous, 1 to 2 mm. long, the latter 1 to 1.5 mm. long; bracts and bractlets very small, oblong, hairy, caducous, the latter opposite and close to the calyx. Calyx cupulate, truncate, broad, minutely ferruginous-pubescent, 2.5 to 3 mm. long, usually with minute yellow spots around the base. Petals purple, turning to white toward the base, the wings and carina sparsely yellow-spotted; standard orbicular, emarginate, concave, subbilobulate or auriculate and plicate-callous at the base, minutely pubescent without along the veins, the claw about 1 mm. long, the blade about 8.5 mm. long and 9 mm. broad, the margins broadly involute; wings elongate, convex, straight and longitudinally plicate, broadly auriculate, obtuse at the apex, sparsely pubescent or glabrous, the claw 2.5 mm. long, the blade 7.5 mm. long, 3 to 3.5 mm. broad; carinal petals subfalcate, subauriculate, broadly rounded at the apex, longitudinally plicate, glabrous or subciliate at the apex, the claw 2.5 mm. long, the blade 3 mm. broad. Staminal tube and free part of the filaments almost straight, glabrous, the vexillar stamen free at the base. Ovary sessile, linear, finely grayish-pubescent, 5 mm. long, 6 to 8-ovulate; style strongly arcuate, pubescent at the base; stigma inconspicuous.

Legume (immature) short, sublanceolate, more or less oblique, tapering at the base to a filiform stipe, more or less cochleate, glabrous, usually 1-seeded, ending with the

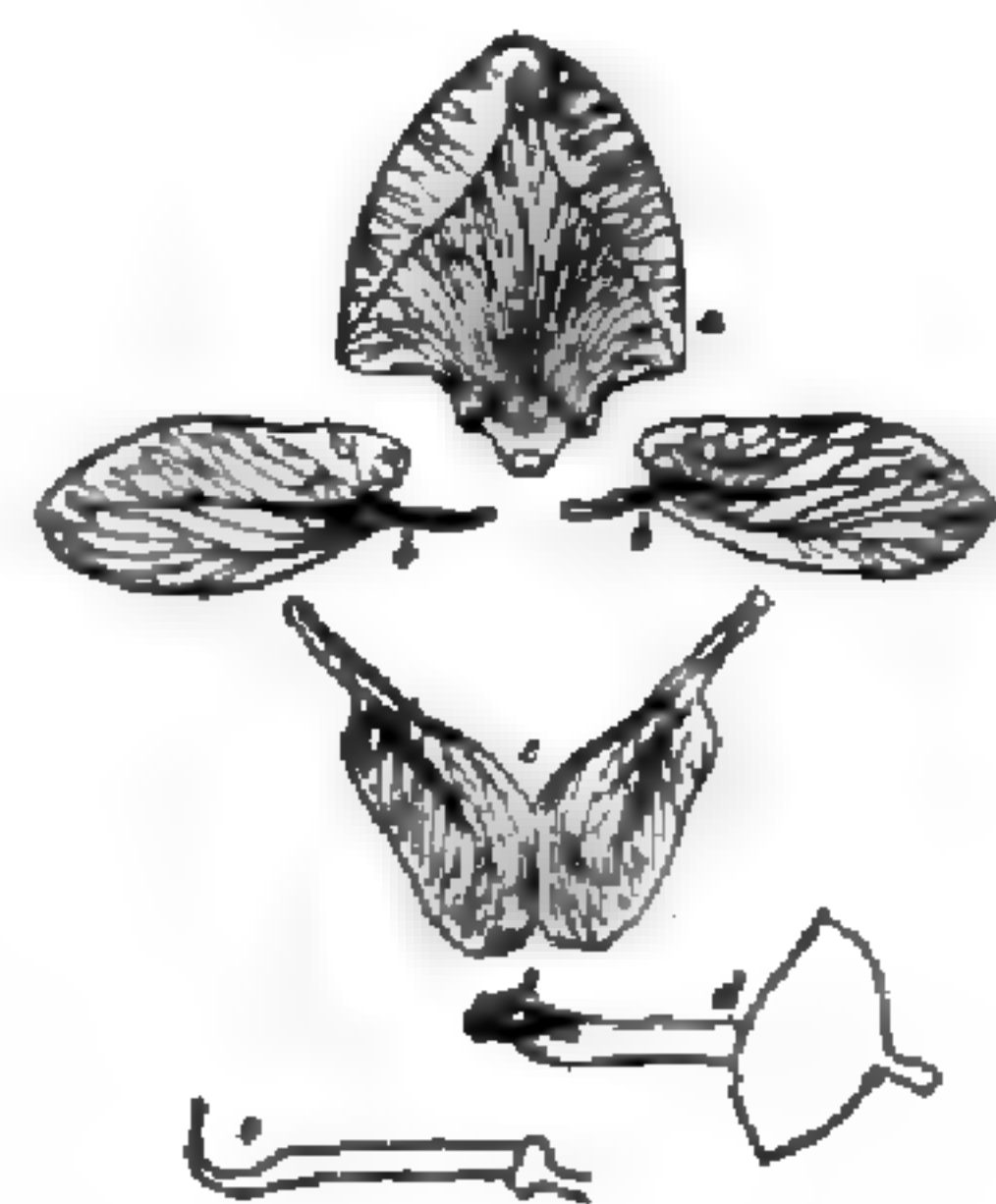


FIG. 23. — *Lonchocarpus lanceolatus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Palmer 1433.

EXPLANATION OF PLATE 5.—Fruits of 3 species of *Lonchocarpus*. Fig. A, *L. orotinus*, from specimen collected by Tonduz (Inst. Fis. Geogr. Costa Rica, no. 13570); fig. B, *L. atropurpureus*, from H. H. Smith 22; fig. C, *L. lanceolatus*, from a Mexican specimen collected by Edward Palmer, U. S. National Herbarium no. 305322. Natural size.

persistent style, 2.5 to 3.5 cm. long, 0.9 cm. broad, the vexillar suture thickened at the seed, concave, about 0.5 mm. broad.

The type of this species, from Mexico, is in Pavon's collections, in the Herbar Boissier.

SPECIMENS EXAMINED:

MEXICO: Imala, Sinaloa, flowers, August, 1891, *Palmer* 1433; probably from the same locality, immature fruits, *Palmer* without number or data (U.S. National Herbarium, no. 305322). Between Rosario and Acaponeta, Sinaloa, flowers, July 28, 1897, *Rose* 1873.

The number of leaflets is often 15 and the fruits on our specimens, though immature, are developed enough to show that this species belongs to the subgenus *Neuroscapha*, and not to the section *Densiflori* as suggested by Bentham.

28. *Lonchocarpus yucatanensis* Pittier, sp. nov.

FIGURE 24.

Branchlets stout, gray, lenticellate, the younger parts pubescent.

Leaves 5 or rarely 7-foliolate, the rachis slender, canaliculate, minutely pubescent, 4 to 6 cm. long. Leaflets membranous, the petiolules puberulous-tomentose, canaliculate, about 3 mm. long, the blades ovate-oblong or ovate-elliptic, cuneate at the base, obtuse or subemarginate at the apex, 3 to 6 cm. long, 1.3 to 2.5 cm. broad, reticulate on both faces, sparsely pilosulous or glabrous above except on the hairy costa and veins, paler and sparsely pilosulous beneath, the costa hairy and prominent. Stipules very small, ovate, pubescent, caducous.

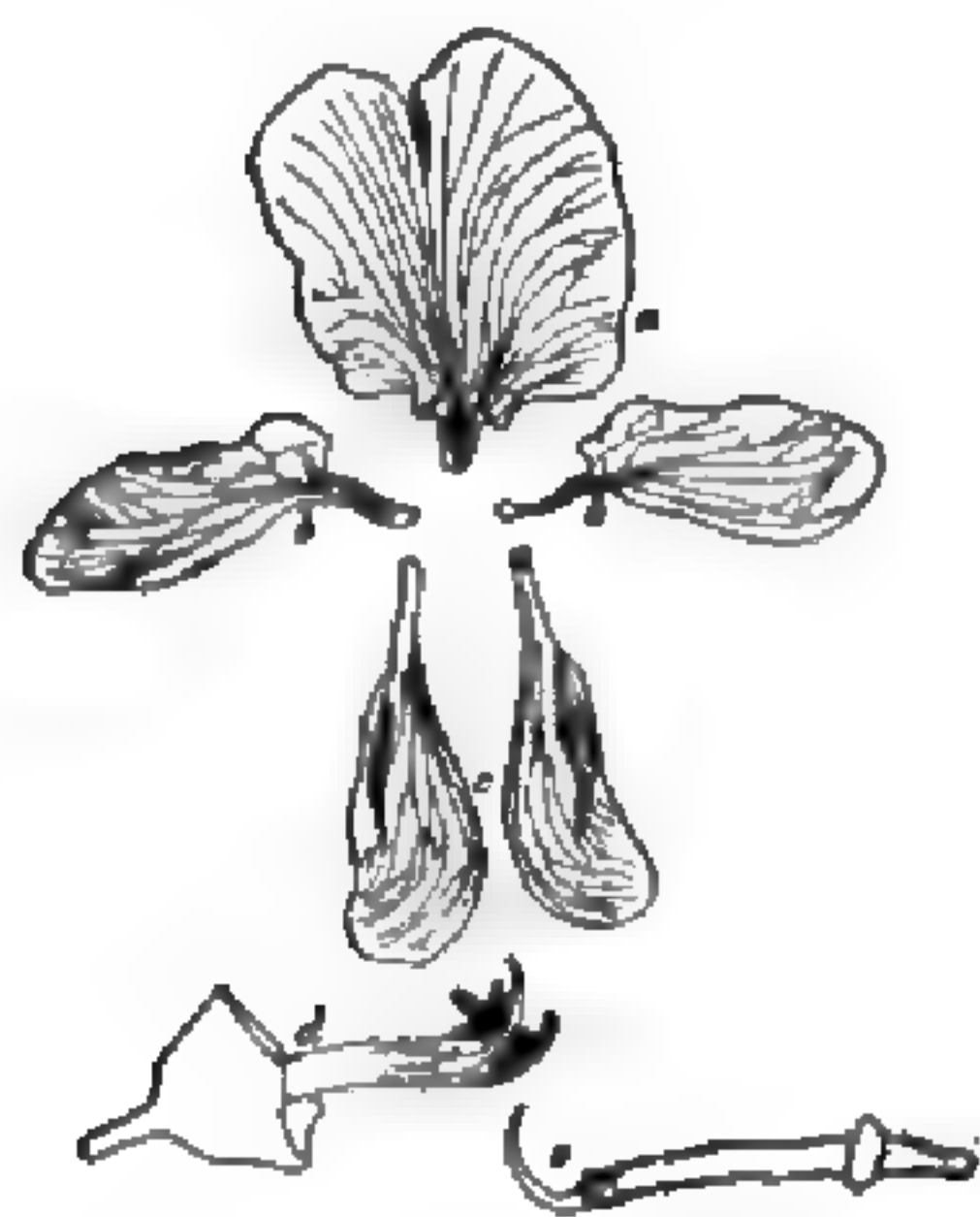


FIG. 24. — *Lonchocarpus yucatanensis*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From *Gaumer* 1146.

Racemes axillary, the rachis pubescent, about 7 cm. long. Peduncles and pedicels short, densely pubescent, the former usually biflorous, 1.5 mm. long or less, the latter 2 to 2.5 mm. long; bracts and bractlets ovate, pubescent, the latter a single pair close to the calyx. Calyx cupulate, slightly 5-toothed, nearly 3 mm. long, densely grayish-pubescent. Petals pinkish or purplish; standard suborbicular, equally broad at base and apex, concave, 2-lobulate and callous at the base, deeply emarginate at the apex, sparsely pubescent on the back, pubescent

inside above the small lobules, the lateral margins involute, the claw about 1 mm. long, the blade 8 mm. long, 7.5 mm. broad; wings adhering to the keel, very oblique, elongate, auriculate, obtuse at the apex, glabrous, the claw 2 to 2.5 mm. long, the blade 6.5 to 7 mm. long, 2 to 2.5 mm. broad; carinal petals often parted, obovate and subfalcate, obtuse, plicate longitudinally, slightly pubescent at the apex, the claw as in the wings, the blade about 6 mm. long and 2.5 to 2.7 mm. long. Anthers large, ovate-elliptic; vexillar stamen free at the base. Ovary linear, densely hairy, about 5.5 mm. long, 7 to 9-ovulate; style glabrous, strongly arcuate.

Legume not known.

Type in the herbarium of the Field Museum of Natural History, no. 437778, collected at El Progreso, Yucatán, Mexico, by Dr. G. F. Gaumer (no. 1146).

A near relative of *L. atropurpureus*, differing in the pubescence, in the smaller number of leaflets, in the shape and size of the petals and of the anthers, in the curvature of the style, etc.

29. *Lonchocarpus orotinus* Pittier, sp. nov.

PLATE 5, A. FIGURE 25.

A small tree, up to 8 meters high, the crown rounded, the branchlets brownish, densely lenticellate, at first sparsely pubescent.

Leaves 7-foliolate, rarely 5 or 9-foliolate, the rachis slender, canaliculate, sparsely pilosulous, 3.5 to 9 cm. long. Leaflets membranous, the petiolules canaliculate, hairy, 1.5 to 3 mm. long, the blades ovate-lanceolate or ovate-elliptic, attenuate and acute at the base, narrowly acuminate and subacute at the apex, 2 to 7.5 cm. long, 1 to 2.5 cm.

broad, minutely reticulate and pilose or pilosulous on the costa and veins above, paler and sparsely pubescent beneath. Stipules small, ovate, cano-pubescent, caducous.

Racemes axillary, the flowers scattered, the rachis sparsely pubescent, 5 to 9 cm. long. Peduncles sparsely pubescent, biflorous, about 2 mm. long; pedicels densely pubescent, 1 to 2 mm. long; bracts and bractlets pubescent, ovate-oblong, the latter opposite and close to the calyx. Calyx cupulate, subtruncate, silky-pubescent without, about 2.5 cm. long. Petals purplish, all minutely pubescent at the apex; standard orbicular, very concave, subbilobulate and emarginate at the base, emarginate at the apex, the claw 1 mm. long or less, the blade about 8.5 mm. long and 9 mm. broad, the basal lobules and lateral margins inflexed; wings adhering to the keel, elongate, auriculate, the claw 2 mm. long, the blade 6.5 to 7 mm. long, 2.3 to 3 mm. broad; carinal petals cohering or free, obovate-oblique, broadly obtuse at the apex, the claw as in the wings, the blade about 5 mm. long, 2 to 2.5 mm. broad. Vexillar stamen free at the base. Ovary linear, densely white-pubescent, about 4.5 mm. long, 5-ovulate; style strongly arcuate; stigma capitellate, subbilobulate.

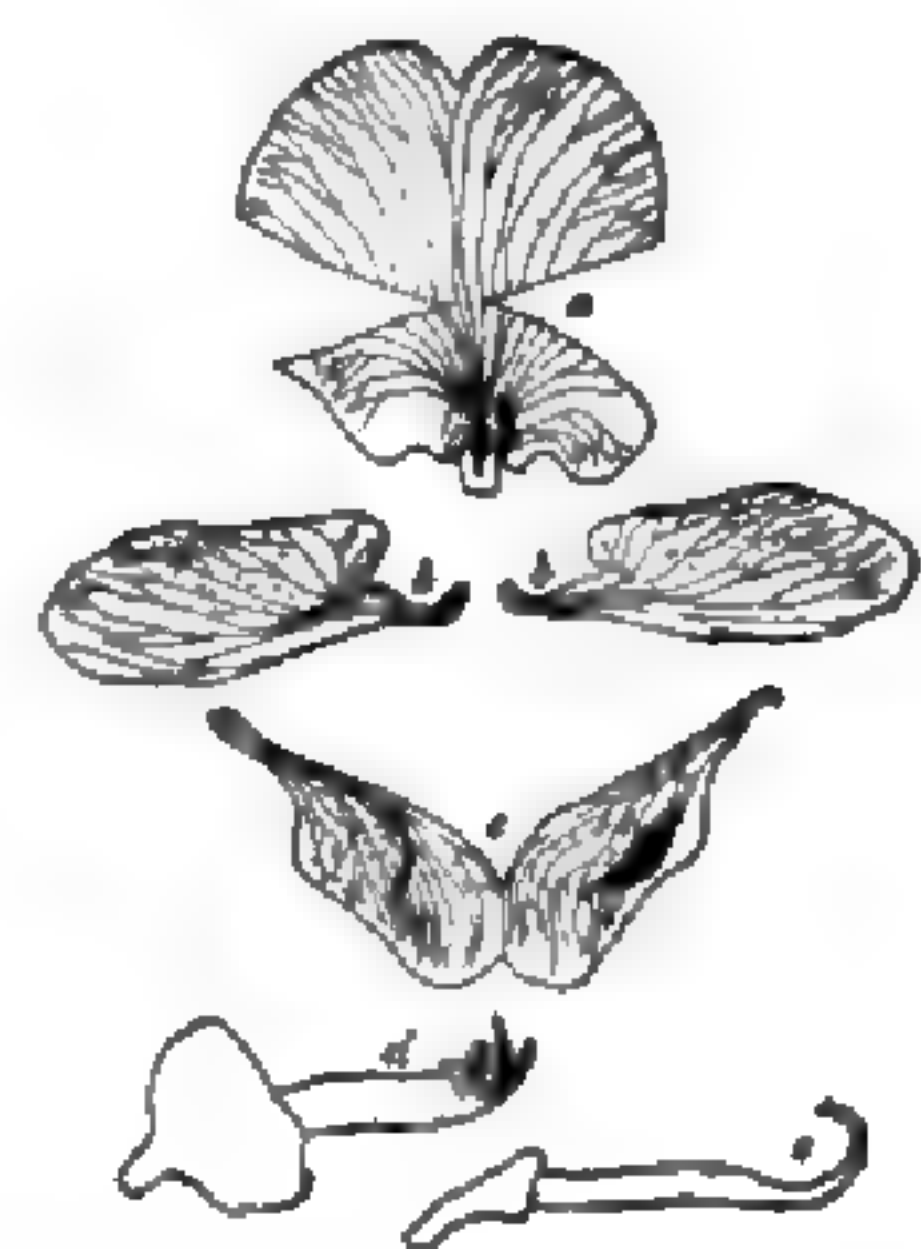


FIG. 25.—*Lonchocarpus orotinus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From *Inst. Fís. Geogr. Costa Rica* 2731.

Legume obovate or elongate, long attenuate stipitate, rounded or acuminate at the apex, coriaceous, glabrous, either 1-seeded, then 3.5 to 4.5 cm. long, 1.6 to 1.7 cm. broad, or 2-seeded, then more or less constricted and thin between the seeds and 6.5 cm. long or more; carinal margin concave, about 4 mm. broad in front of the seeds. Seeds reniform, compressed, about 6 mm. long and 8 mm. broad.

Type in the John Donnell Smith Herbarium, collected on the strand belt at Salinas Bay, Guanacaste, Costa Rica, in flower, June, 1890, by A. Tonduz (*Inst. Fís. Geogr. Costa Rica*, no. 2731).

ADDITIONAL SPECIMENS EXAMINED:

COSTA RICA: Around Orotina, near San Mateo, in flower, June 15 to 17, 1906, *Maxon* 578. Around Nicoya, on wooded hills, in fruit, December, 1899, *Tonduz* (*Inst. Fís. Geogr. Costa Rica*, no. 13570).

Capt. Smith gave this species a manuscript name but afterward referred it to *L. atropurpureus* Benth. Although undoubtedly very closely related to that species, its distinctness is quite evident and fully supported by the characters of the fruit, which Capt. Smith had not seen. The leaflets are almost always 7, narrowly and almost acutely acuminate, not obtuse or shortly obtuse-acuminate; furthermore, while in *L. atropurpureus* the groove of the petiolules is broadly open, it is closed and subtubular in the new species. The flowers are slightly smaller, the pubescence of the petals is more marked, and the standard is of a distinct shape at the base. The legume is much broader and does not seem to contain more than 2 seeds. But for the fact that *L. parviflorus* Benth. is described as having almost always 5 leaflets, whereas the leaves of the Costa Rican tree usually show 7, I should feel inclined to refer the latter to that species.

The specific name *calyculatus*, suggested by Capt. Smith, is hardly applicable to a *Lonchocarpus*, since there is no involucre of bractlets imitating a calyx, hence with his courteous consent I have dropped his name and designated the species from one of the localities at which it has been collected.

EXPLANATION OF PLATE 5.—See p. 73.

30. *Lonchocarpus hondurensis* Benth. *Journ. Proc. Linn. Soc. Bot.* 4: Suppl. 91. 1860. FIGURE 26.

A small tree 6 to 8 meters high, the branchlets stout, brownish, glabrous, sparsely lenticellate.

Leaves 5-foliolate, glabrous, the rachis broadly canaliculate, 4 to 7 cm. long. Leaflets coriaceous, the petiolules stout, narrowly canaliculate, 3 to 4 mm. long, the blades

ovate-oblong, subcuneate at the base, the apex with a short, obtuse acumen, 3.5 to 10 cm. long, 1.5 to 4 cm. broad, sublustrous and light green above, paler beneath, the costa and veins prominent. Stipules not seen.

Racemes erect, solitary in the axils of the upper leaves and forming long panicles at the ends of the branchlets, the rachis glabrous, angulate, densely flowered, 6 to 12

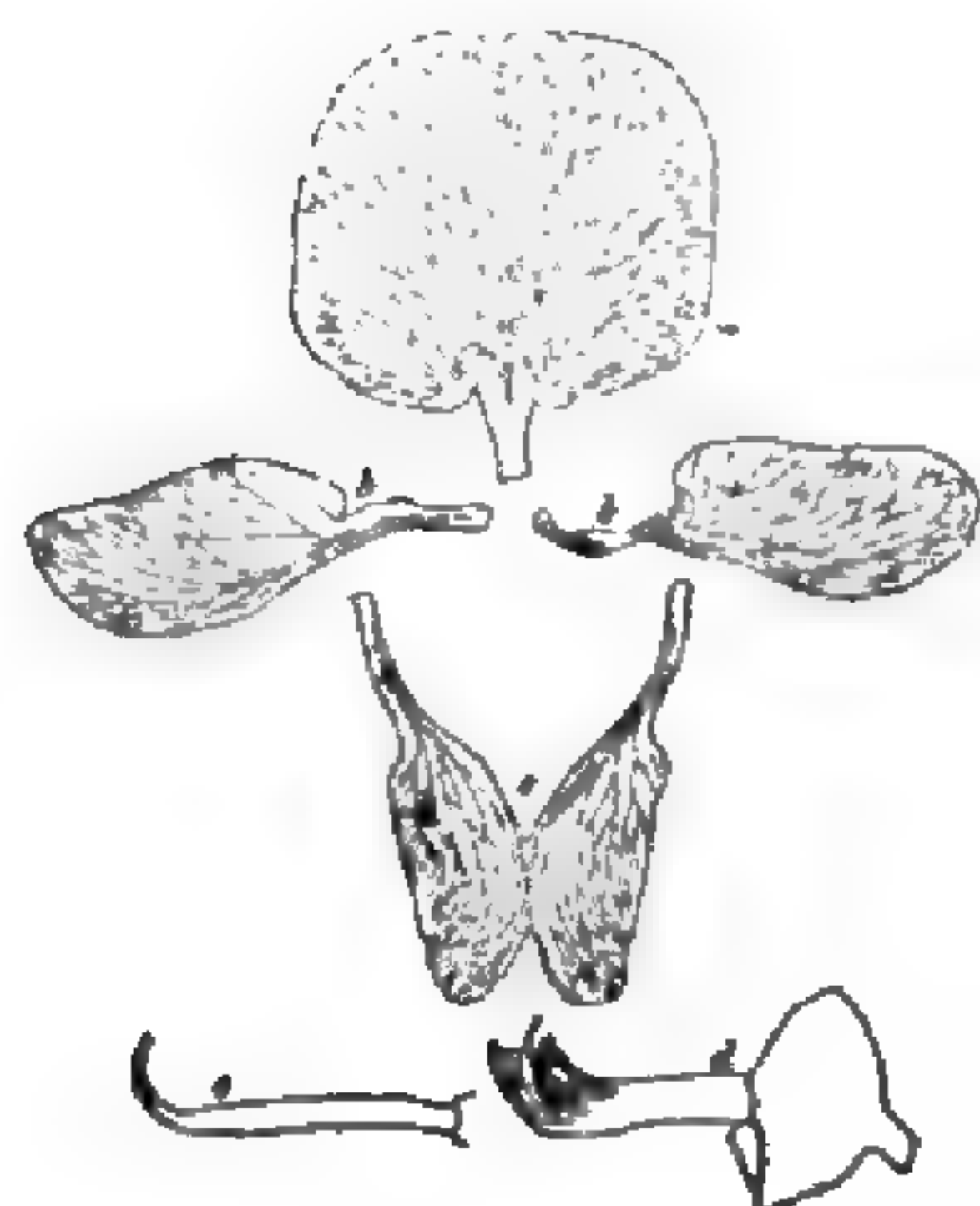


FIG. 26.—*Lonchocarpus hondurensis*. a, Standard; b, wings; c, carinal petals; d, calyx, stamens, and style; e, pistil. Natural size. From *Rovirosa* 121.

cm. long. Peduncles and pedicels minutely pubescent, the former solitary, mostly biflorous, about 1.5 mm. long, the latter 1 mm. long or less; bracts and bractlets broadly ovate, pubescent, the latter about 0.5 mm. long, opposite and close to the calyx. Calyx broadly cupulate, subdentate, minutely pubescent, about 3.5 mm. long. Petals purplish red; standard broadly orbicular, sublobulate and callous at the base, slightly emarginate at the apex, the claw 2.5 mm. long, the blade minutely pubescent on the back, about 9 mm. long and 10 mm. broad; wings elongate, oblique, adhering to the keel, auriculate, rounded-obtuse at the apex, slightly pubescent, the claw 3.5 mm. long or less, the blade 7.5 mm. long, 3.5 mm. broad; carinal petals elongate, subfalcate, rounded-obtuse, scarcely auriculate, minutely pubescent without, the claw 3.5 to 4 mm. long, the blade 6.5 mm. long, 3 mm. broad. Staminal tube dilated at the base, the vexillar stamen free, the upper free part of the filaments minutely hairy. Ovary stipitate, linear,

pubescent, about 6.5 mm. long, 5 to 9-ovulate; style arcuate, pubescent at the base; stigma capitellate.

Legume not known.

Type from Honduras, collected by R. Temple (Banks Herbarium).

The above description is from *Wilson* 706 (see below).

SPECIMENS EXAMINED:

BRITISH HONDURAS: Botanic Station, Belize, in flower, June, 1898, *Campbell*.
Near Puerto Sierra, along Highland Creek, in flower, March 8, 1903, *Wilson* 706.

MEXICO: Llanos del Carrizal, Tabasco (common), in flower, February 28, 1888, *Rovirosa* 121.

In Tabasco this has the vernacular name "gusano."

A beautiful and striking species, not easily confused. It has already been reported from Tabasco by E. P. Johnson (no. 31).

31. *Lonchocarpus comitensis* Pittier, sp. nov.

A small tree or a shrub, the branchlets stout, grayish, densely lenticellate, the younger parts densely fuscous-tomentose.

Leaves 7 to 11-foliolate, the rachis fuscous-tomentose, terete, 2 to 4 cm. long. Leaflets subcoriaceous, the petiolules tomentose, hardly over 1 mm. long, the blades ovate, oblong, or obovate, rounded and subattenuate at the apex, 1 to 3.5 cm. long, 0.7 to 1.5 cm. broad, pilosulous above, the costa impressed, beneath reticulate, pubescent, the costa and veins prominulous and ferruginous. Stipules not seen.

Racemes axillary, the rachis densely fuscous-pubescent, 4 to 6 cm. long. Flowers about 1.5 cm. long. Peduncles and pedicels fuscous-tomentose, the former biflorous, about 1 mm. long, the latter 4 to 5 mm. long; bracts and bractlets oblong, fuscous-pubescent, 1 to 2 mm. long, the latter opposite and appressed to the calyx. Calyx cupulate, broad, truncate, densely fuscous-tomentose, about 5 mm. long. Petals not seen. Vexillar stamen free. Ovary sessile, linear, pubescent, about 8 mm. long, 5-ovulate; style slightly arcuate, sparsely pubescent.

Fruit not known.

Type in the U. S. National Herbarium, no. 470630, collected at Comitán, State of Chiapas, Mexico, in flower, April 3, 1904, by E. A. Goldman (no. 827).

This species is characterized by its small leaves, not unlike those of *Lonchocarpus atropurpureus* Benth. or other members of the same section, its peculiar pubescence, its large flowers with the style of *L. mexicanus*, etc. Unfortunately the petals have been destroyed by insects and the fruits are wanting.

32. *Lonchocarpus lucidus* Pittier, sp. nov.

FIGURE 27.

Lonchocarpus sericeus var. *glabrescens* Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 88. 1860.

A large tree with rounded crown; bark of the branchlets dark brown, pubescent, lenticellose.

Leaves 7 to 13-foliolate, the rachis 12 to 17 cm. long, more or less ferruginous-pubescent, deeply sulcate. Leaflets coriaceous; petiolules 5 mm. long, subsulcate, hairy; leaflet blades elliptic-ovate or obovate, slightly oblique, rounded at the base, shortly obtuse-acuminate at the apex, 6 to 11 cm. long, 2 to 6 cm. broad, glabrous, dark green and lustrous above, paler and sparsely hairy on the costa and nerves beneath, the nerves impressed above and prominent beneath. Stipules not seen.

Racemes axillary or paniculate at the ends of the branchlets, the rachis 20 to 24 cm. long (as long as or longer than the leaves), slightly ferruginous-pubescent, the peduncular part 5.5 cm. long. Flowers 12 to 14 mm. long (without the pedicels), solitary or 2 or 3 together in distant clusters, the peduncles and pedicels ferruginous-pubescent, the former 1.5 to 2 mm. long, 2-flowered, the latter about 1 mm. long; bracts and bractlets ovate or orbicular, the former about 1 mm. long, ferruginous-pubescent, the latter opposite and contiguous to the calyx, 1.5 mm. long, 2 mm. broad. Calyx cupulate, toothed, about 5 mm. long, densely ferruginous-pubescent, the 2 anterior teeth rounded and coalescent, the 3 posterior acute but almost obsolete. Petals pink; standard ovate or orbicular, 2-lobulate at the base, emarginate at the apex, almost flat, densely silky-hairy on the back, the claw 2 mm. long, the blade 10 mm. long, 8 mm. broad, the basal lobes callous and revolute; wings auriculate, rounded at the apex, adhering to the carina, slightly grayish-pubescent along the median line, the claw 4.5 mm. long, the blade 8.5 to 9 mm. long, 4 mm. broad; carinal petals falcate, rounded at the apex, mostly free, grayish-pubescent, the claw 5 mm. long, the blade 8 mm. long, 3.5 mm. broad. Vexillar stamen free at the base. Ovary 7 mm. long, silky-pubescent, 5-ovulate; style incurved, 3.5 to 4 mm. long, sharply separated from the ovary, hairy almost to the tip; stigma capitellate.

Legume flat, 1 to 4-seeded, coriaceous, glabrescent, 3 to 11 cm. long, 1.7 cm. broad, more or less contracted between the seeds, the vexillar margin broadened opposite the seeds (nearly 5 mm. broad) and slightly concave. Seeds reniform, flat, dark brown, about 11 mm. long and 6 mm. broad.

Type in the U. S. National Herbarium, no. 334017, collected at Santo Domingo de Osa, Costa Rica, in forests, flowers, March, 1896, by A. Tonduz (Inst. Fís. Geogr. Costa Rica, no. 9950). The legume and seeds are described from Pittier 3879, cited below.

OTHER SPECIMENS EXAMINED:

PANAMA: Gatún Valley, in submerged forest, immature flowers, March 25, 1914, Pittier 6508. Along Río Fató, Province of Colón, in forest, fruits, July 8, 1911, Pittier 3879.

This species is very common in Panama. Besides differing from *L. sericeus* (Poir.) H. B. K. in several details of its general description, the type of the legume is distinct, the vexillar margin being concave and broad and not sharply carinate. Consequently

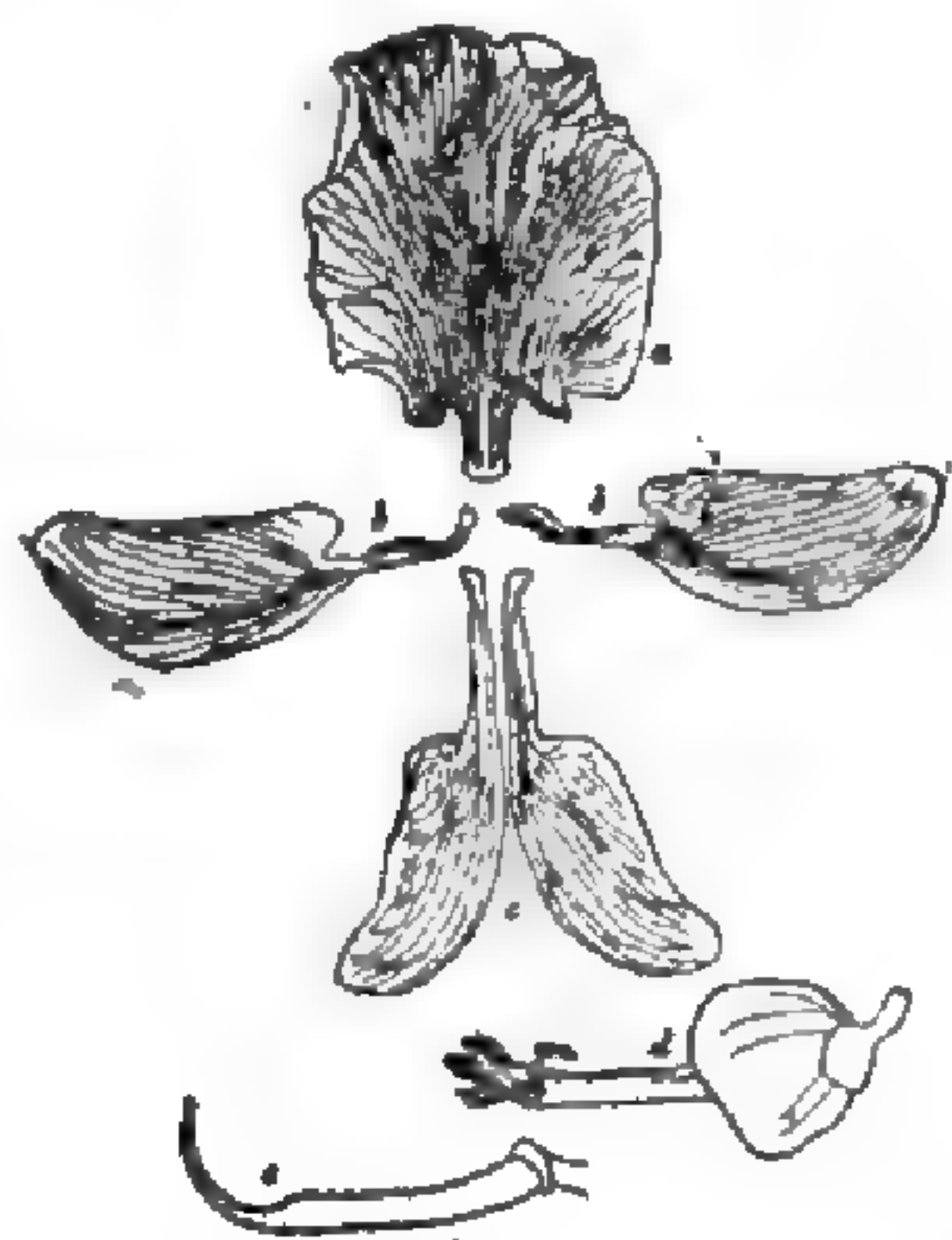


FIG. 27.—*Lonchocarpus lucidus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Inst. Fís. Geogr. Costa Rica 9950.

it can not be considered a form of the latter species. Neither can it be identified with *L. domingensis* DC., which has the fruits of *L. sericeus*, and it is very doubtful whether it corresponds to *L. macrophyllus* H. B. K., as surmised by Benth.

33. *Lonchocarpus constrictus* Pittier, sp. nov.

PLATE 6, A. FIGURE 28.

An erect shrub or small tree 2 to 5 meters high, deciduous, the bark grayish or reddish, lenticellate on the branchlets; young shoots glabrous.

Leaves 5 to 11-foliolate, mostly 7 to 9-foliolate, the rachis canaliculate, slender, glabrous or glabrescent, 2 to 10 cm. long. Leaflets coriaceous, the petiolules 2.5 to 5 mm. long, canaliculate, at first densely hairy, later sparsely hairy and darkish, the blades ovate or obovate, rounded or cuneate at the base, rounded-obtuse or emarginate at the apex, 1.5 to 7 cm. long, 1.5 to 4 cm. broad, glabrous above, beneath at first softly hairy and later glabrous, the costa and veins prominent. Stipules triangular-acute, about 2 mm. long, densely canescent, deciduous.

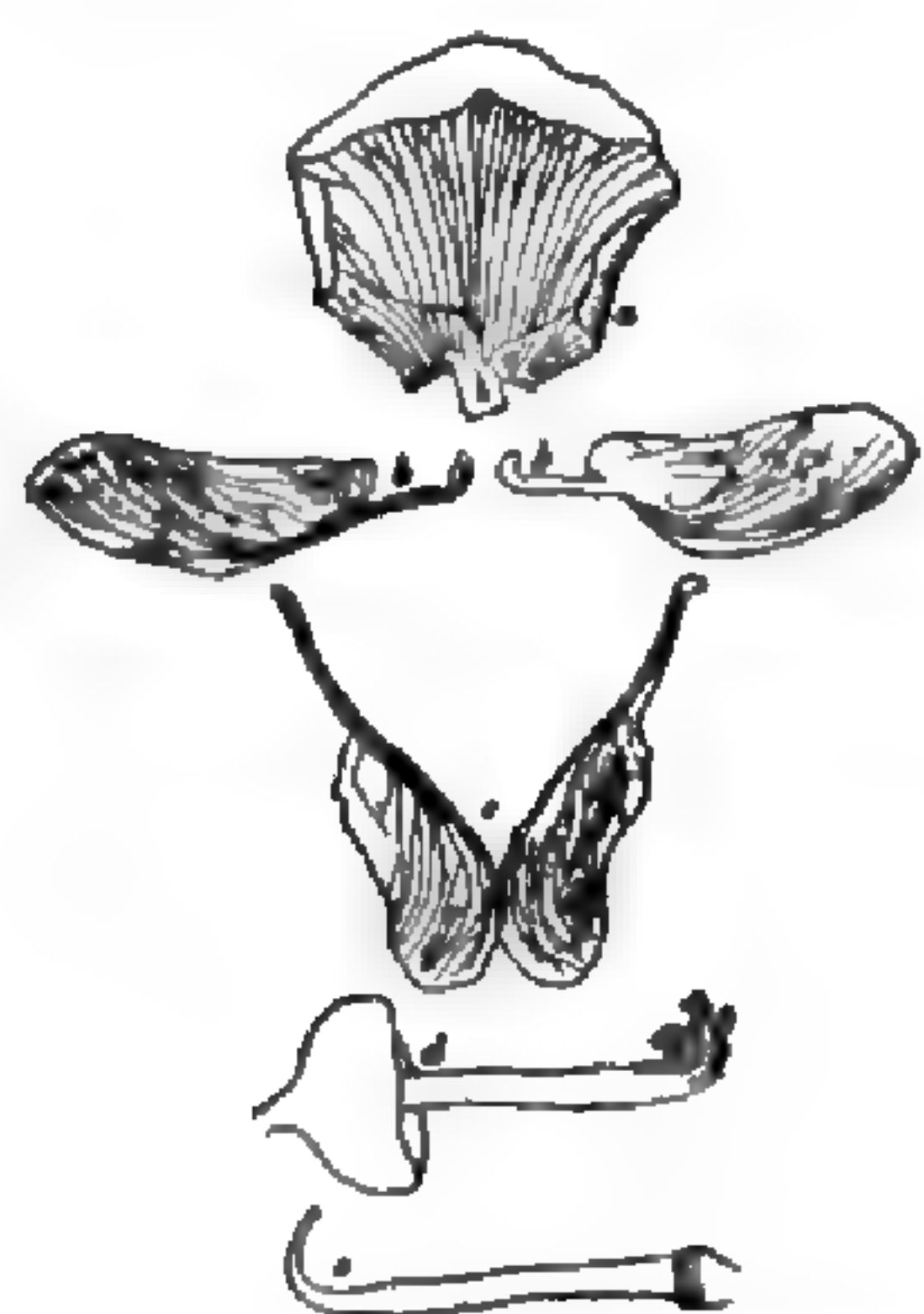


FIG. 28.—*Lonchocarpus constrictus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Palmer 1379.

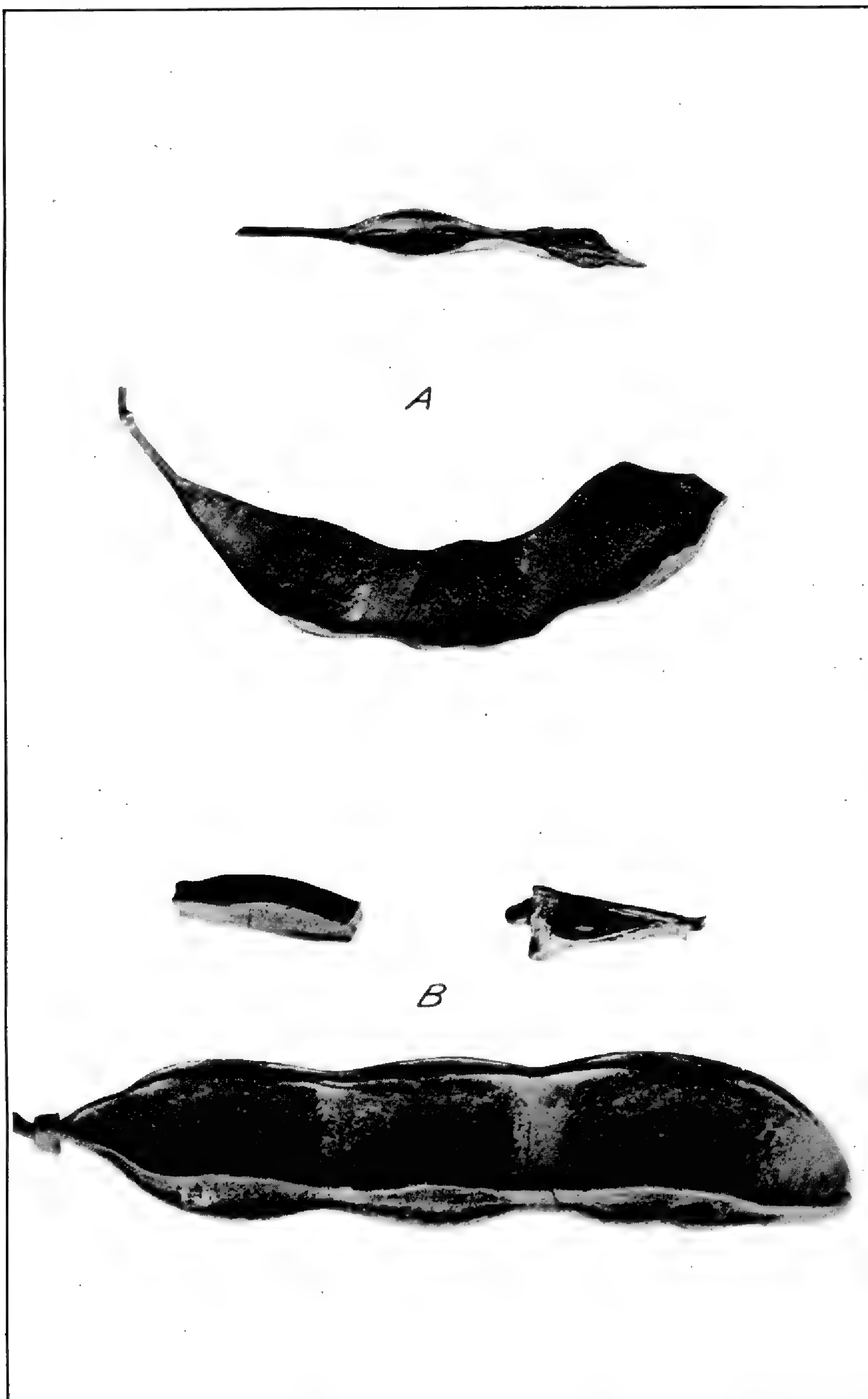
Racemes appearing before the leaves, solitary on the nodes of young branchlets, the rachis cano-pubescent, 4 to 6 cm. long, provided at the base with an oblong, caducous, canescent-tomentose bract about 3 mm. long; peduncles and pedicels cano-pubescent, the former very short (1 mm. or less), solitary, mostly biflorous, the latter about 2 mm. long; bractlets subulate, hairy, about 1 mm. long, the upper pair a little below the calyx, rather conspicuous. Calyx cupulate, subturbinate at the base, sinuate-denticulate on the margin, fulvous-pubescent without, 3 to 3.5 mm. long. Petals reddish purple; standard orbicular, concave, slightly emarginate at the apex, densely silvery-pubescent without, with a green spot at the base, the

claw arcuate and obliquely inserted, 1 to 1.5 mm. long, the blade about 9.5 mm. long and broad, with the basal lobes inconspicuous, callous, each bearing on the inside a short calcarate appendage, the margins involute; wings adhering to the carina, oblique, oblong, rounded-auriculate, rounded at the apex, sparsely pilosulous without at the apex, irregularly spotted, the claw about 3 mm. long, the blade 8 to 8.5 mm. long, about 2.5 mm. broad; carinal petals falcate, convex but not always plicate, scarcely auriculate, rounded-obtuse, densely pubescent along the upper half of the carinal margin, irregularly spotted, the claw about 4 mm. long, the blade 6.5 mm. long, 2.6 mm. broad. Staminal tube glabrous, the vexillar stamen free at the base. Ovary sessile, linear, densely cano-pubescent, about 7.5 mm. long, 6-ovulate; style strongly arcuate, pubescent at the base; stigma capitellate, inconspicuous.

Legume long and slender stipitate, oblique, arcuate, acute at the apex, glabrous, 1.5 cm. broad, either 1-seeded and about 5.5 cm. long, or 2 or 3-seeded and up to 10.5 cm. long, constricted between the seeds, the carinal suture broadened at the seeds, flat, marginate on both sides, 6 to 7 mm. broad. Seeds obovate, hardly incurved on the hilum side, 12 mm. long, 7 mm. broad, about 4.5 mm. thick, reddish brown, the hilum deep, white-bordered.

Type in the U. S. National Herbarium, no. 208513, collected at Manzanillo, State of Colima, Mexico, flowers and young leaves, March, 1891 by Edward Palmer (no. 1379). The description of the adult leaves and fruits is from National Herbarium no. 266224, collected at Acapulco, State of Guerrero, Mexico, along the sea beach, between October, 1894, and March, 1895, *Palmer* 73.

In the shape of the leaflets and fruits this species departs from all the other members of the subgenus *Neuroscapha*. The standard is curiously plicate and appendiculate at the base, and the spotted wings and carina remind one of the species of the section *Punctati*, but the leaves are not pellucid-punctate. The bractlets also constitute a good distinctive character.



FRUITS OF (A) LONCHOCARPUS CONSTRICTUS PITTIER AND (B) L. SERICEUS (POIR.)
H. B. K.

34. *Lonchocarpus guatemalensis* Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 87. 1860. FIGURE 29.

A deciduous tree, the branchlets grayish, glabrous, covered with numerous suborbicular lenticels.

Leaves 5 or 7-foliolate, at maturity entirely glabrous, the rachis terete (not canaliculate), 4.5 to 9.5 cm. long. Leaflets coriaceous, sparsely pellucid-punctate, the petioles canaliculate, 4 to 6.5 mm. long, the blades ovate-oblong (the terminal one often obovate), subcuneate at the base, shortly obtuse-acuminate at the apex, 4 to 10 cm. long, 2 to 5.2 cm. broad, dark green and sublustrous above, paler beneath, the costa prominent. Stipules not seen.

Racemes axillary on foliate or defoliate nodes, solitary, geminate, 3 to 5-fasciculate, or forming small branched panicles, the rachis more or less grayish-pubescent, 6 to 14 cm. long. Flowers preceding the new leaves or appearing at about the same time. Peduncles and pedicels grayish-pubescent, the former very short (2 mm. long or less), the latter about 4 mm. long; bracts and bractlets ovate-acute, very small, grayish-pubescent without, glabrous within, the latter slightly remote from the calyx. Calyx cupulate, subturbinate at the base, 4.5 to 5 mm. long, densely grayish-pubescent, the margin (distinctly 5-toothed in the bud) sinuate, slightly 5-lobulate. Petals pinkish or purplish, densely yellow-dotted, the carinal ones cohering; standard orbicular, more or less oblique, elobate but callous-plicate at the base, emarginate at the apex, the claw 3.5 mm. long, the blade 9.5 mm. long, 11 mm. broad, densely silky-pubescent without; wings oblong, obtuse at the apex, glabrous, the auricle on the vexillar side very prominent, the claw 4.5 to 5 mm. long, the blade about 8 mm. long and 3.5 mm. broad; carinal petals rounded at the apex, hardly lobulate on the vexillar side, pubescent along the carinal side without, the claw nearly 5 mm. long, the blade 7 to 7.5 mm. long, 3.7 mm. broad. Vexillar stamen free at the base, the margins of the openings in the staminal tube callous-thickened. Ovary sessile, linear, densely grayish-hairy, about 7 mm. long, 7-ovulate; style arcuate, hairy at the base; stigma subcapitellate.

Fruit not known.

Type (in flower) collected in Guatemala by Friedrichsthal.

The above description is from J. D. Smith's no. 7852, collected at Cubilquitz, Alta Verapaz, Guatemala, at an altitude of 350 meters by H. von Türckheim, in April, 1901. Bentham cites also *Jurgensen* 159 from southern Mexico. To this species I refer further *Kerber* 420, from Mexico; *Tonduz* (Inst. Fís. Geogr. Costa Rica, no. 13860), collected at Nicoya, Costa Rica; and sheet no. 48928 of the U. S. National Herbarium, collected by C. Wright in Nicaragua.

Bentham places this species at the head of his section *Neuroscaphi* and describes the vexillar suture as concave and 3.2 mm. broad. On the other hand, the tree just described, most of whose characters agree with those ascribed to *L. guatemalensis*, has the pellucid-punctate leaves of the species of the section *Punctati* and the yellow-spotted petals of some of them. It would so be intermediate between the true *Lonchocarpus* and the group forming the genus *Neuroscapha* Tulasne. I do not know, however, whether the immature legume described by Bentham really belongs to the type specimen, and in the negative case, either a confusion or a misplacing of species has been made. The fruits are indispensable to elucidate the point.

Lonchocarpus guatemalensis differs from the species of the section *Punctati* in the absence of basal lobules on the standard and in the more developed auricles

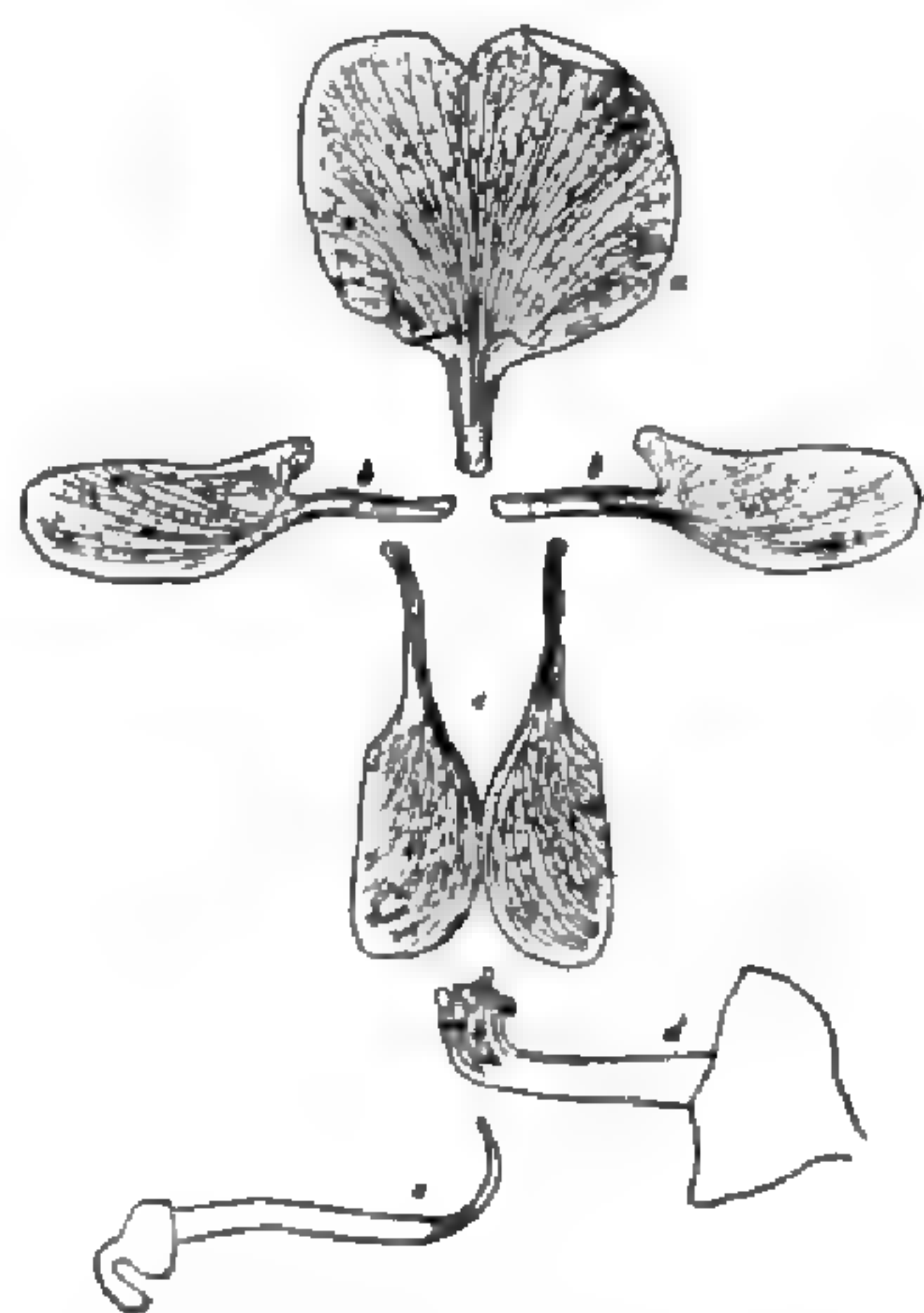


FIG. 29.—*Lonchocarpus guatemalensis*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From J. D. Smith 7852.

of the wings; its nearest relatives would be, perhaps, *L. proteranthus* and *L. punctatus*.

The above-described specimens were distributed as *Lonchocarpus sericeus* H. B. K. var. *sericeus* Micheli, an obviously mistaken identification.

35. *Lonchocarpus emarginatus* Pittier, sp. nov.

FIGURE 30.

Branchlets short, grayish, lenticellate, at first tomentellous.

Leaves 5 to 11-foliolate, the rachis slightly canaliculate, hairy, 3 to 8.5 cm. long. Leaflets coriaceous, the petiolules canaliculate, hairy, 3 to 4 mm. long, the blades oblong, rounded at the base, emarginate at the apex, 2 to 5 cm. long, sparsely pubescent or glabrescent above, beneath paler, reticulate, sparsely pubescent, the costa and veins prominent. Stipules not seen.

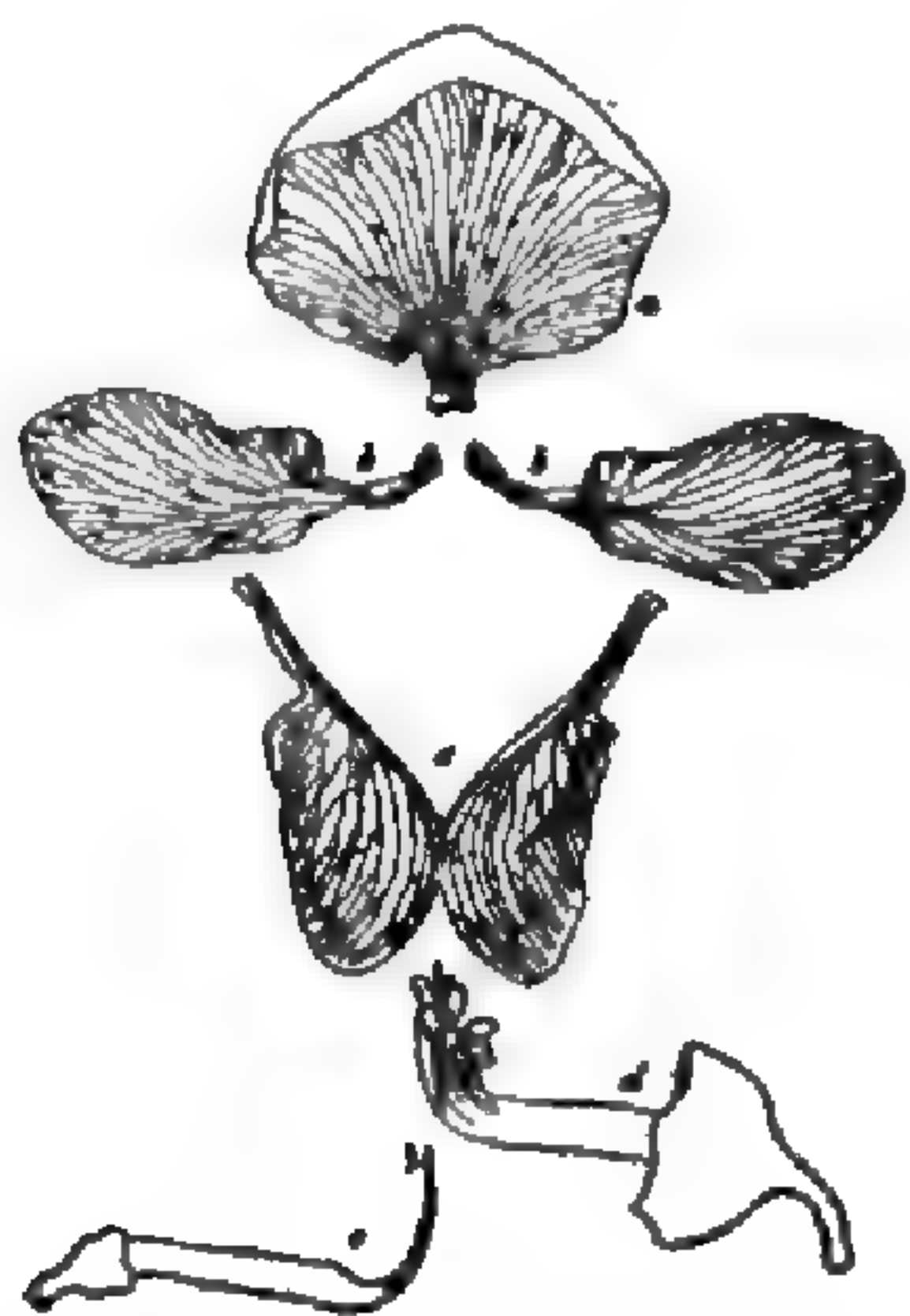


FIG. 30.—*Lonchocarpus emarginatus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Purpus 6814.

Racemes axillary and forming small panicles at the ends of the branchlets, the rachis hairy, 4 to 6 cm. long, densely flowered. Peduncles solitary, mostly biflorous, about 2 mm. long, hairy; pedicels about 3 mm. long, cano-pubescent; bracts and bractlets very small, the latter on the lower half of the pedicel. Calyx cupulate, truncate or denticulate, subattenuate at the base, about 3.5 mm. long, silky-pubescent without and ciliate on the margin. Petals purplish or pinkish; standard orbicular (broader than long), concave, subbilobulate and callous-plicate at the base, slightly emarginate at the apex, pubescent without, the claw 1.5 to 2 mm. long, the blade about 9.5 mm. long, 11 to 11.5 mm. broad, the margins inflexed; wings adhering to the keel, oblique, oblong, subauriculate, obtuse at the apex, glabrous, the claw about 3.5 mm. long, the blade 8 mm. long, 4 to 4.5 mm. broad; carinal petals falcate, auriculate, obtuse, slightly pubescent without along the carinal margin, the claw 4 mm. long, the blade 7 to 7.5 mm. long, 4 mm. broad. Vexillar stamen free at the

base, the staminal tube glabrous. Ovary linear, stipitate, densely cano-pubescent, about 5.5 mm. long, 3 or 4-ovulate; style long, acicular, arcuate, pubescent at the base; stigma capitellate.

Legume not known.

Type in the U. S. National Herbarium, no. 567145, collected at El Picacho, near San Gerónimo, State of Oaxaca, Mexico, in flower, October, 1913, by C. A. Purpus (no. 6814).

This species is distinct from every other in Middle America. In the absence of the fruit its systematic place in the genus remains doubtful. The characters of the flowers, however, point to a close relationship with the species of the section *Carinati*, series *Sericiflori*.

36. *Lonchocarpus salvadorensis* Pittier, sp. nov.

FIGURE 31.

A large deciduous tree. Bark of the branchlets brownish, glabrescent, lenticellose; young shoots brownish-pubescent.

Leaves 7-foliolate, the rachis, petiolules, and lower surface of the leaflets at first densely brownish-pubescent, later glabrous; rachis 10 cm. long, sulcate at the base. Leaflets coriaceous, the petiolules terete, 6 to 10 mm. long, the blades ovate to elliptic (the terminal one more or less obovate), subcuneate at the base, acuminate at the apex, 4 to 10 cm. long, 2 to 5 cm. broad, pilosulous above at first, glabrous and lustrous later, the nervation prominent beneath. Stipules very small, hairy.

Racemes paniculate at the ends of defoliate branchlets, short, stout, densely flowered, the rachis 12 to 25 cm. long, pubescent at first, glabrous later. Peduncles usually biflorous, hairy, very short; pedicels 2 mm. long or less; bracts and bractlets grayish-

pubescent, the former short (less than 1 mm. long), broad, early caducous, the upper ones opposite, suborbicular, about 3 mm. long and broad, appressed to the base of the calyx and almost persistent. Calyx truncate, about 5 mm. long, densely grayish-pubescent without. Petals purple, with white claws; standard suborbicular, emarginate at the apex, silky-pubescent on the back, the claw about 3 mm. long, the blade 15 mm. long and broad, the basal lobules small, callous and revolute; wings oblong, auriculate, the claw 5.5 mm. long, the blade 11 mm. long, 5.5 mm. broad, pubescent outside along the lower margin, sparsely so on the claw; carinal petals mostly free, subauriculate, obtuse, pubescent without and within along the lower margin and on the claw, this about 5 mm. long, the blade 10 mm. long, 5 mm. broad. Vexillar stamen free at the base; staminal tube sparsely pubescent all over, about 12 mm. long. Ovary short-stipitate, linear, 9-ovulate, about 9 mm. long, densely grayish-pubescent; style arcuate, sparsely pubescent almost to the tip; stigma capitellate.

Fruit not known.

Type in the U. S. National Herbarium, no. 578330, collected near Nahuizalco, Department of Sonsonate, El Salvador, at an altitude of 550 meters, in flower, February 16, 1907, by H. Pittier (no. 1932).

Another specimen of the same is *Renson* 238, collected in flower near San Salvador. I refer also to this species J. D. Smith's no. 4143, collected along the Río de los Esclavos, Department of Santa Rosa, in the adjacent coastal belt of Guatemala, by Heyde and Lux. These specimens differ from the type only in the elongate racemes. They were determined by the late Micheli as *L. guatemalensis* Benth., an association which is indicated at first sight as erroneous on account of the large bractlets contiguous to the calyx.

Lonchocarpus salvadorensis is related closely to *L. sericeus*, but differs in the reduced number of leaflets, the short, dense, paniculate inflorescences, blossoming before or simultaneously with the appearance of the new leaves, the large bractlets, the pubescence of the petals and staminal tube, the shape of the standard, etc.

Vernacular name, "sangre de chuchó;" local Nahuatl, "i-kua-pelo."

37. *Lonchocarpus palmeri* Rose, Contr. U. S. Nat. Herb. 1: 322. 1895.

FIGURE 32.

A spreading tree 6 to 10 meters high, the trunk 15 to 30 cm. in diameter, the branchlets grayish brown, at first ferruginous-pubescent, lenticellate.

Leaves 7 to 13-foliolate, the rachis narrowly canaliculate, 8 to 15 cm. long, more or less pubescent. Leaflets coriaceous, the petiolules obscurely canaliculate, densely ferruginous-pubescent, 5 to 6 mm. long, the blades ovate, oblong, or obovate, rounded at the base, obtuse or shortly obtuse-acuminate at the apex, 4.5 to 9.5 cm. long, 2.5 to 4.5 cm. broad, glabrous or glabrescent and sublustrous above, finely reticulate and puberulous beneath, the costa and veins more or less hairy and impressed on the upper face, prominent and ferruginous-pubescent beneath. Stipules not seen.

Racemes solitary on defoliate nodes at the ends of the branchlets, the rachis ferruginous-pubescent, 12 to 25 cm. long. Peduncles and pedicels ferruginous-pubescent, the former 3.5 mm. long, 2-pedicellate, the latter about 3 mm. long, each often bearing 2 or 3 flower buds; bracts and bractlets ovate, ferruginous-pubescent, the latter about 2 mm. long, appressed to the calyx. Calyx cupulate, rather narrow, about 5 mm. long, densely ferruginous-pubescent, the margin sinuate-dentate. Petals diversely colored; standard suborbicular, subemarginate at the apex, densely silky-

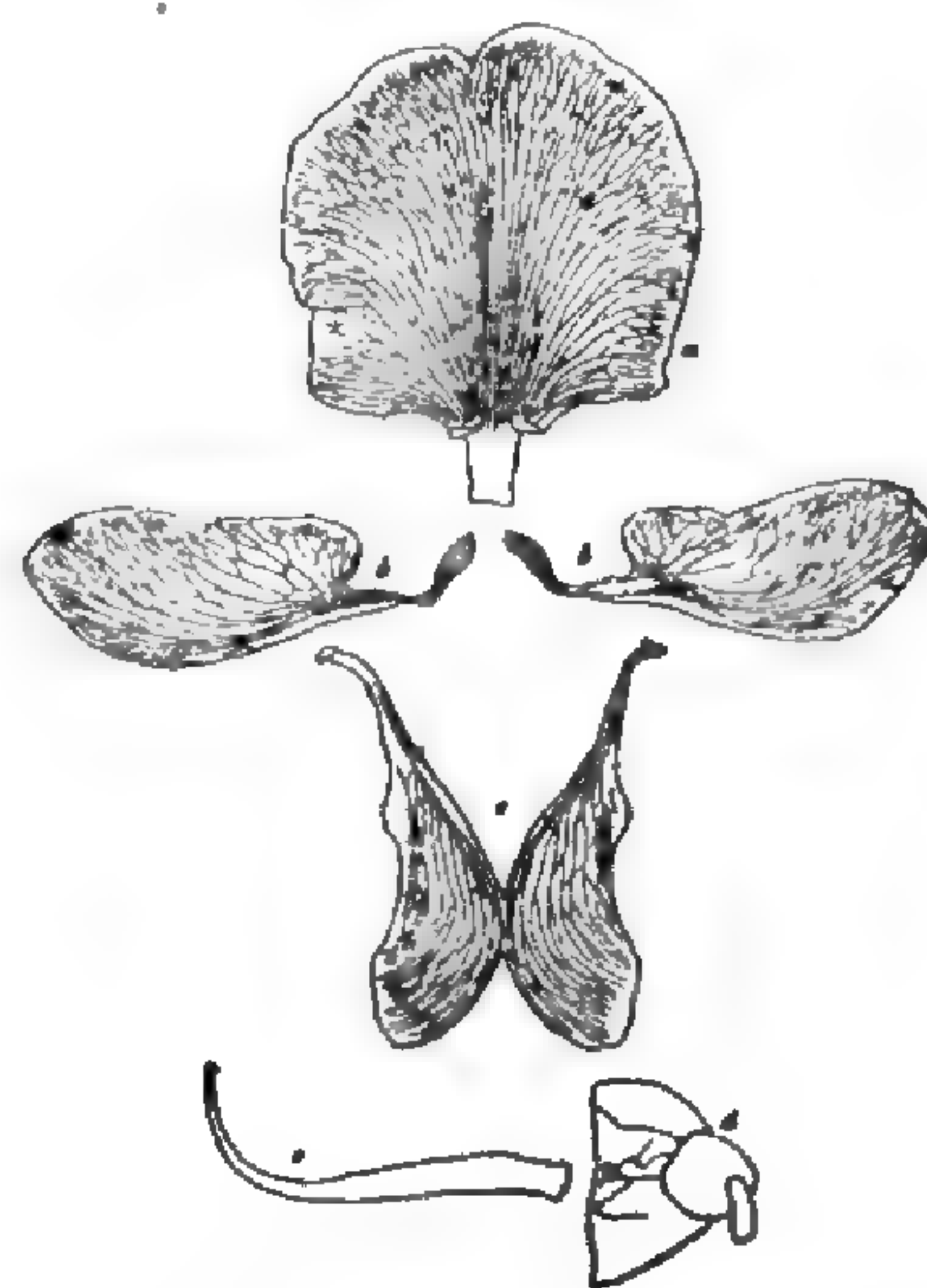


FIG. 31.—*Lonchocarpus salvadorensis*. a, Standard; b, wings; c, carinal petals; d, calyx; e, pistil. Natural size. From Pittier 1932.

pubescent on the back, greenish yellow, the basal lobules remote from the claw and subacute, the claw about 3 mm. long, obliquely inserted, the blade about 13 mm. long and 13.2 mm. broad; wings and keel purplish or light mauve, the former oblong, auriculate on the vexillar side, truncate-obtuse at the apex, sparsely villous along



FIG. 32.—*Lonchocarpus palmeri*.
a, Standard; b, wings; c, carinal
petals; d, calyx and stamens;
e, pistil. Natural size. From
Palmer 1021.

the carinal side down to the claw, adhering to the carina, the claw 4.5 to 5 mm. long, the blade 10 mm. long, 4.5 mm. broad; carinal petals falcate, convex, subacute, auriculate, plicate, slightly cohering, pubescent without along the carinal side and on the claw and within at the base of the blade, the claw 5 mm. long, the blade about 10 mm. long and 3.5 mm. broad. Staminal tube broadly dilated at the base, sparsely hairy along the vexillar side; upper end of the filament villous; vexillar stamen free at the base. Ovary linear, somewhat attenuate at the base, densely villous, about 7 mm. long, 8-ovulate; style arcuate, villous at the base; stigma inconspicuous.

Legume stipitate, acute at the apex, 3 to 8 cm. long, 2.8 cm. broad, 1 to 5-seeded, the vexillar suture sharp-edged and bordered by 2 parallel ridges thickened along the seeds. Seeds reniform, about 8.5 mm. long, dark brown.

The type (U. S. National Herbarium, no. 208958) was collected at Manzanillo, State of Colima, Mexico, in flower and fruit, December, 1890, by Edward Palmer (no. 1021).

Closely related to *L. sericeus*, but differing in the size of the flowers, the shape and pubescence of the petals, the hairy stamens, and the greater breadth of the pods.

38. *Lonchocarpus sericeus* (Poir.) H. B. K. Nov. Gen. & Sp. 6: 383. 1823.

PLATE 6, B (facing p. 78). FIGURE 33.

Robinia sericea Poir. in Lam. Encycl. 6: 226. 1804.

A small tree, the branchlets, rachises of the leaves, and those of the inflorescences more or less ferruginous-pubescent, the bark of the branchlets brownish or grayish, lenticellate.

Leaves 7 to 13-foliolate, the rachis 7.5 to 11 cm. long, canaliculate, the groove broader at the insertion of the leaflets, the pubescence dense at first, more or less evanescent later. Leaflets coriaceous, the costa and veins deeply impressed above, prominent beneath, the petiolules 4 to 6 mm. long, more or less ferruginous-hairy, obscurely canaliculate, the blades ovate, obovate, or oblong, rounded at the base, rounded-obtuse or shortly obtuse-acuminate at the apex, 3.5 to 9 cm. long, 2.5 to 3.5 cm. broad, minutely puberulous above at first, glabrous at later stages, minutely pubescent, principally on the costa and veins, beneath. Stipules ovate, obtuse, densely ferruginous-hairy, about 3 mm. long, caducous.

Racemes solitary in the axils of the upper leaves, the rachis (velvety-hairy at first, glabrous in fruiting specimens) 9 to 24 cm. long. Peduncles and pedicels densely ferruginous-pubescent, the former solitary, or 2 or 3 together and then 2-flowered, about 3 mm. long, the latter 2 to 4 mm. long; bracts and bractlets ovate-orbicular, the latter opposite and approximate to the calyx. Calyx cupulate, subtruncate or remotely sinuate-toothed, about 5 mm. long, densely ferruginous-pubescent without. Petals pinkish or purplish; standard suborbicular (broader than long), biauriculate and callous at the base, emarginate at the apex, flat, the claw 2.5 mm. long, the blade 11.5 to 12 mm. long, 14.5 mm. broad, densely silky-pubescent without, and within above the claw; wings adhering to the carina, rounded-auriculate at the base on the vexillar side, obtuse at the apex, slightly silky-pubescent without, the claw 4.5 mm.

long, the blade about 10 mm. long and 5 mm. broad; carinal petals mostly free, falcate, auriculate, more or less distinctly folded along the vexillar margin, densely silky-pubescent on the upper half and along the carinal margin, the claw 4.5 mm. long, the blade about 8.5 mm. long and 3.5 mm. broad. Vexillar stamen free at the base, the tube broadened-auriculate, leaving an ovate opening on each side of the former. Ovary sessile and thickened at the base, linear, roundish, densely canescent-pilose, about 8 mm. long, mostly 7-ovulate; style arcuate, sharply distinguished from the ovary, hairy at the base only; stigma capitellate.

Legume compressed, attenuate at the base, acute at the apex, more or less fulvous-pubescent, the vexillar suture thickened opposite the seeds, sharp on the edge; seeds 1 or 2 to 5, when 1 or 2 the legume ovate-oblique, about 5 cm. long and 2.3 cm. broad, when more, the legume elongate, constricted between the seeds, arcuate with the vexillar side concave, 5 to 12 cm. long, 2.3 cm. broad. Seeds surrounded with a coriaceous endocarp, oblong-reniform, 12 to 14 mm. long, 7 mm. broad, 4 mm. thick, dark chocolate-brown with white hilum.

Type (*Robinia sericea* Poir.) in Jussieu Herbarium, from America. The above description of the flower is based on specimens collected at Castleton Gardens, Jamaica, by Mr. Wm. Harris (no. 9153); that of the fruit from Edward Palmer no. 598, collected at Acapulco, Mexico, October, 1894, to March, 1895.

OTHER SPECIMENS EXAMINED:

MEXICO: María Madre Island, in fruit, May, 1895, *Nelson* 4310. Sihuatanaja, Guerrero, in fruit, April 9, 1903, *Nelson* 7011. Between Rosario, Sinaloa, and Concepción, Tepic, July 28, 1897, *Rose* 3268 (immature specimen).

CUBA: La Herradura, Pinar del Río, in flower, August 26, 1905, *van Hermann* 119.

PORTO RICO: Los Indios de Guayanillo, along the river, immature flowers and imperfect fruits, July 29, 1886, *Sintenis* 4991 (determined by Urban but doubtful).

MARTINIQUE: Marigot, in flower, October, 1869, *Hahn* 1223.

TRINIDAD: *Fendler* 318, young fruits.

This species seems to be widely spread over the West Indies, extending to Mexico in one direction, to Colombia and Brazil in another. It has not been reported as yet from Central America.

According to Bentham its area of dispersion includes western tropical Africa.

EXPLANATION OF PLATE 6.—See p. 78.

39. *Lonchocarpus robustus* Pittier, sp. nov.

FIGURE 34.

A tree, the branchlets thick, nodose, at first ferruginous-pubescent.

Leaves 9 to 13-foliolate, the rachis canaliculate, ferruginous-puberulous, 11 to 18 cm. long. Leaflets submembranous, the petiolules canaliculate, ferruginous-hairy, about 5 mm. long, the blades oblique, ovate or oblong, rounded and subattenuate at the base, obtuse-acuminate at the apex, 4 to 8 cm. long, 2 to 3 cm. broad, glabrous and minutely reticulate above, reticulate and minutely pubescent beneath, the costa and veins sparsely ferruginous-hairy, subimmersed above, very prominent beneath.

Racemes axillary, subpaniculate at the ends of the branchlets, the rachis striate, ferruginous-hairy, 5.5 to 9 cm. long. Peduncles and pedicels ferruginous-pubescent, about 1 mm. long, the former usually biflorous; bracts and bractlets very small and

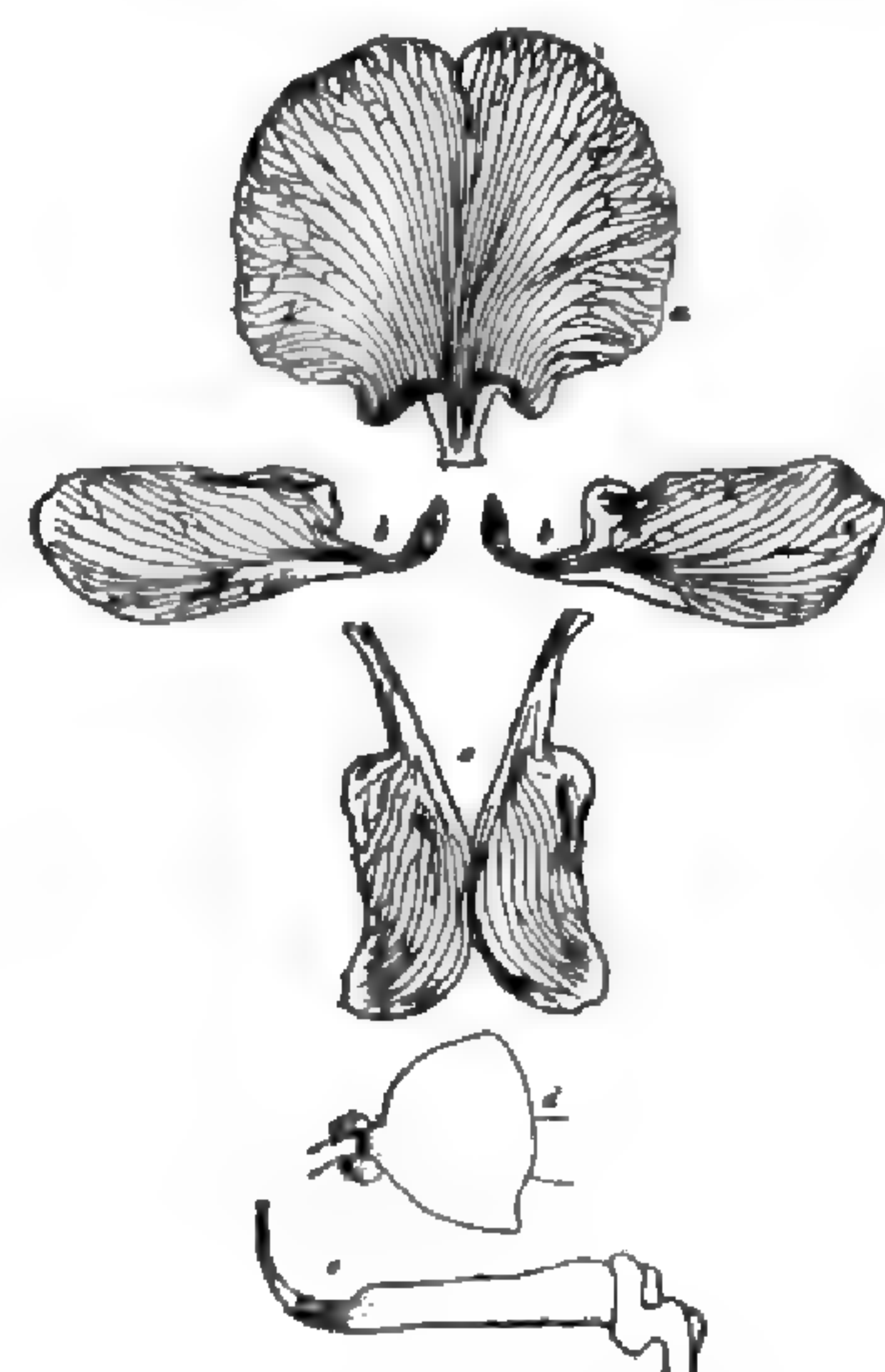


FIG. 33.—*Lonchocarpus sericeus*.
a, Standard; b, wings; c, carinal petals; d, calyx; e, pistil.
Natural size.

caducous, the latter close to the calyx. Petals pinkish or purplish; standard sub-orbicular, concave, subbilobulate, callous-plicate and broader at the base, emarginate at the apex, silky-pubescent without, the claw about 1.5 mm. long, the blade 8 mm.

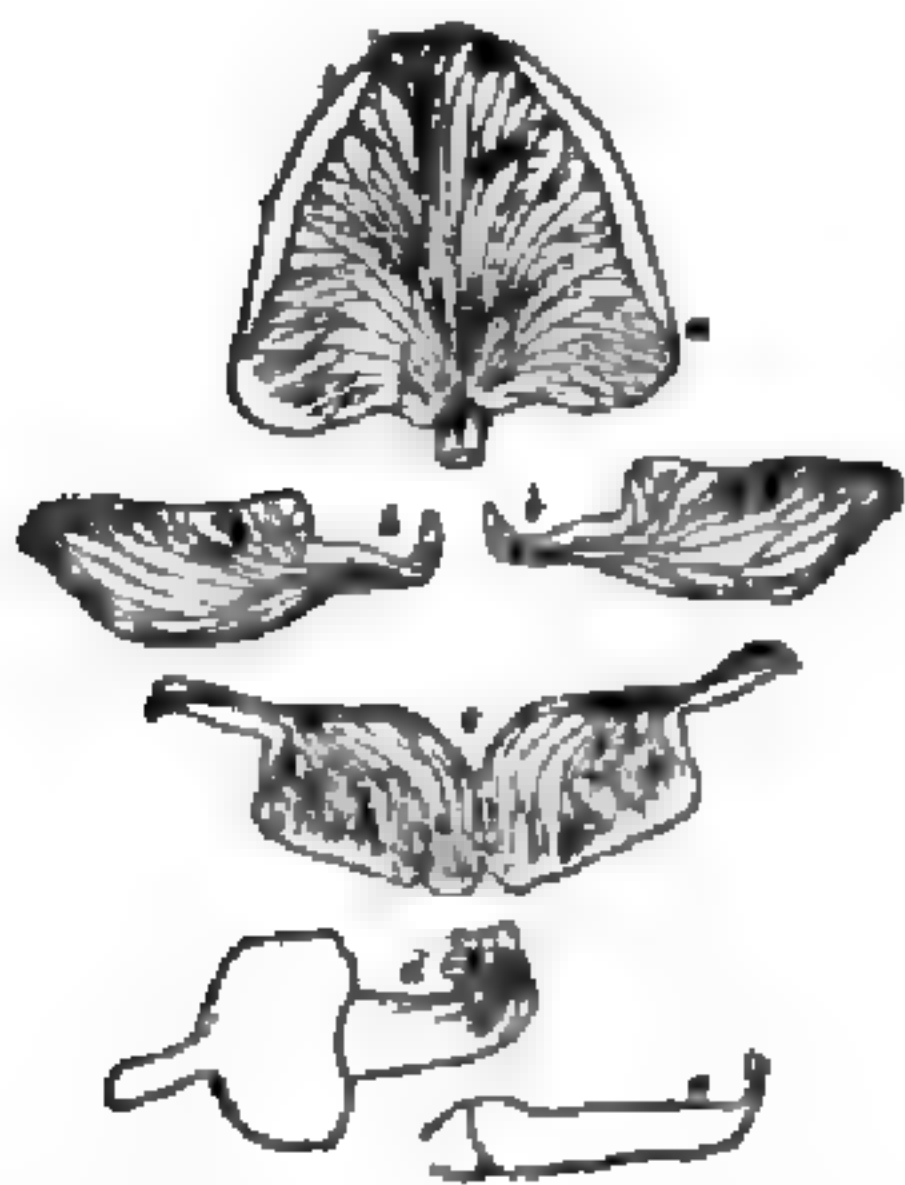


FIG. 34.—*Lonchocarpus robustus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Nelson 3413.

long, 8.5 mm. broad, the margins inflexed; wings elongate, oblique, auriculate, subattenuate toward the obtuse apex, sparsely pubescent without, the claw 3 mm. long, the blade about 6 mm. long, 2.7 mm. broad; carinal petals falcate, obtuse, pubescent along the carinal margin and at the apex, the claw as in the wings, the blade 4.5 mm. long, 3.5 mm. broad. Upper part of the staminal tube and free part of the filaments sparsely ferruginous-pilosulous, the vexillar stamen free at the base. Ovary linear, minutely but densely ferruginous-pubescent, about 5.5 mm. long, 3-ovulate; style short, ferruginous-hairy; stigma capitellate, large for the genus.

Legume not known.

Type in the U. S. National Herbarium, no. 252378, collected near Yajalón, State of Chiapas, Mexico, in flower, November 21, 1895, by E. W. Nelson (no. 3413).

A species closely related to *Lonchocarpus sericeus* (Poir.) H. B. K. and *L. santarosanus* Donn. Smith, differing from both in the pubescence, the shape of the leaflets, and the size and indument of the flowers. It comes closer to *L. santarosanus* in the length and shape of the pistil and in the very broad carinal petals, but the ovary is 3-ovulate and the leaflets are distinct in several details.

40. *Lonchocarpus santarosanus* Donn. Smith, Bot. Gaz. 57: 418. 1914.

FIGURE 35.

A tree 6 to 8 meters high, the branchlets grayish, minutely lenticellate, at first pubescent.

Leaves 11 to 15-foliolate, the rachis minutely pubescent, canaliculate, 15 to 21 cm. long. Leaflets membranous or subcoriaceous, the petiolules hairy, canaliculate, 4 to 6 mm. long, the blades lanceolate, oblong, or ovate-oblong, rounded or subacute at the base, rather long and acutely acuminate, 4 to 7.5 cm. long, 1.5 to 2.5 cm. broad, glabrous and minutely reticulate above, beneath paler, densely pubescent, subreticulate, the costa and veins prominent. Stipules not seen.

Racemes axillary, densely flowered, the rachis puberulous, 6 to 12 cm. long. Peduncles and pedicels hairy, the former 4 to 6 mm. long, mostly biflorous, the latter 2 to 3 mm. long; bracts and bractlets small, ovate-oblong, pubescent, the latter inserted a little below the calyx. Calyx cupulate, truncate, broad, 1.5 to 2 mm. long, pubescent. Petals scarlet (fide J. D. Smith); standard orbicular, concave, silky-pubescent without, distinctly callous-plicate at the base, emarginate at the apex, the margins reflexed, the claw about 1 mm. long, arcuate, the blade about 6 mm. long and 7.5 mm. broad; wings adhering to the keel, oblong, auriculate, obtuse, the claw 2 mm.

long, the blade about 4 mm. long, 1.8 mm. broad; carinal petals falcate, very oblique, truncate at the base, obtuse, the claw as in the wings, the blade 3.5 mm. long, 2.5 mm. broad. Vexillar stamen free at the base; filaments minutely pubescent. Ovary linear, stipitate, densely pubescent, about 3.5 mm. long, 2-ovulate; style sharply bent at the base; stigma capitellate.

Legume not known.

Type in the John Donnell Smith Herbarium, collected at Mataquescuintla, Department of Santa Rosa, Guatemala, at an altitude of about 1,560 meters, flowers (all fungus-infected), March, 1894, by Heyde and Lux (J. D. Smith, no. 6328).



FIG. 35.—*Lonchocarpus santarosanus*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From J. D. Smith 6328.

The affinities of this species seem to be with *Lonchocarpus sericeus* (Poir.) H. B. K., but the leaflets are more numerous and distinctively shaped, the flowers small, the ovary 2-ovulate, etc.

EXCLUDED OR DOUBTFUL SPECIES.

LONCHOCARPUS ERIOPHYLLUS Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 94. 1860.

FIGURE 36.

This is the type of the section Eriophylli Benth. The tree differs from the usual *Lonchocarpus* type in the very numerous leaflets, the long narrow wings, and the numerous ovules. In the absence of the legume it might just as well find a place in the genus *Gliricidia*. Langlassé's specimens, cited below, have been compared with the type, through the kindness of the authorities of the Royal Botanic Gardens at Kew, and are described as follows:

A tree 4 to 5 meters high; young shoots, rachises of the leaves and inflorescences, petiolules, and pedicels softly grayish-tomentose; bark of the branchlets reddish brown, smooth, the lenticels inconspicuous.

Leaves 11 to 23-foliolate, the rachis up to 14 cm. long; petiolules 3 mm. long; leaflet blades oblong, sometimes oblique, broadly rounded at the base, subacute and mucronulate at the apex, 2 to 3.5 cm. long, 1 to 1.5 cm. broad, pubescent above, grayish villous tomentose beneath; costa and veins impressed and often conspicuous on the upper face, prominent beneath. Stipules very small, triangular-acute, early deciduous.

Spikes axillary on the young shoots, erect, 10 to 12 cm. long, rather densely flowered. Flowers geminate, about 2 cm. long from base of calyx to apex of the petals, the peduncles 4 mm. long, the pedicels 5 to 6 mm. long; bracts and bractlets very small, ovate, deciduous. Calyx broadly and shallowly cupulate, 5 to 6 mm. long, softly tomentose without, 5-toothed, the 2 anterior teeth more or less rounded, close together, and almost coalescent, the 3 posterior ones remote and acute. Petals reddish purple, softly villous without, glabrous within; standard suborbicular, the claw 3 mm. long, the

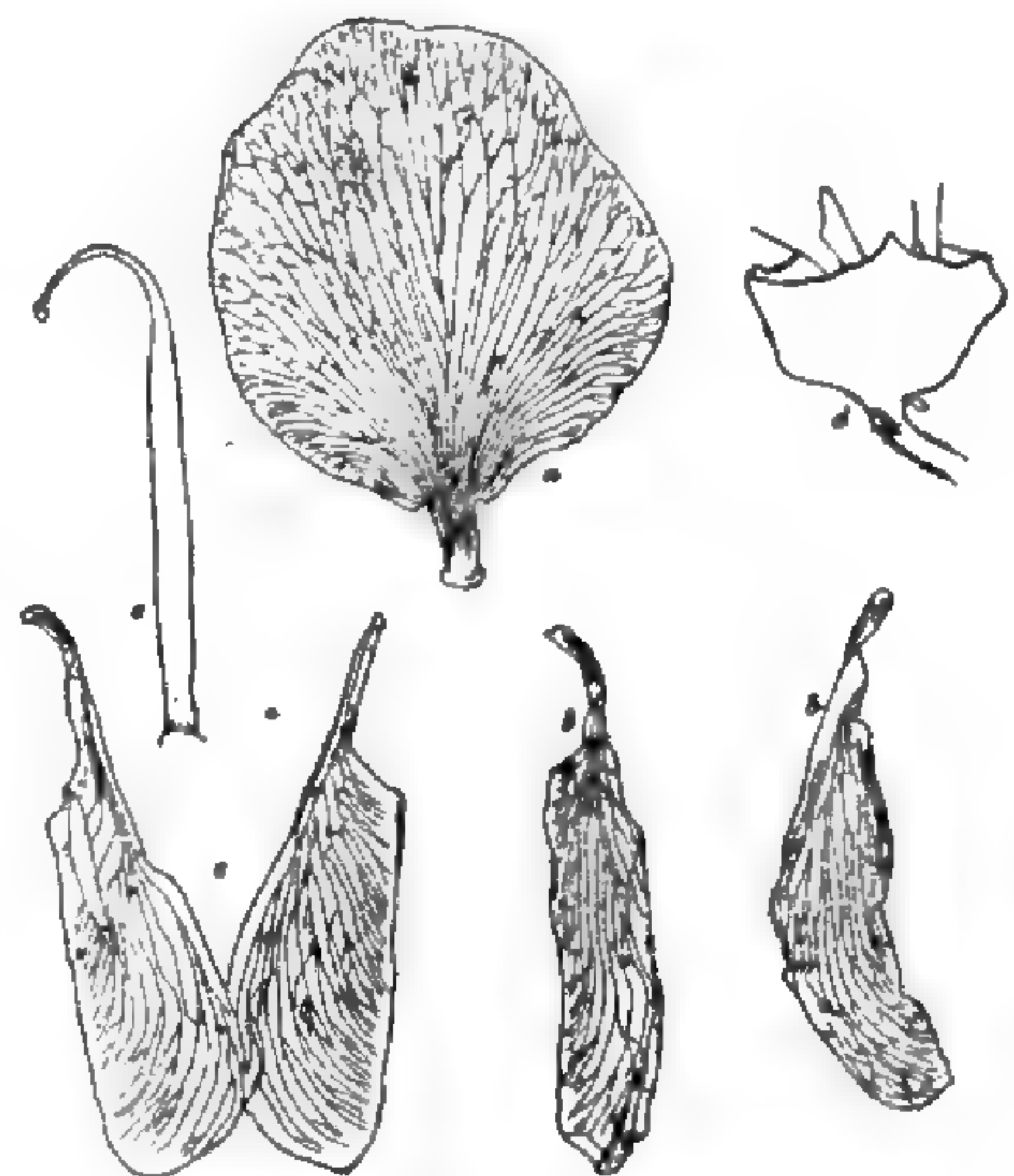


FIG. 36.—*Lonchocarpus eriophyllus*. a, Standard; b, wings; c, carinal petals. Natural size.

blade 17 mm. long, 16 mm. broad, the median axis and claw in a straight line; wings oblong, subfalcate, oblique, slightly adhering to the keel, the claw about 4.5 mm. long, the blade 15 to 15.5 mm. long, 4.5 mm. broad; carinal petals falcate, slightly coherent, the claw 4.5 mm. long, the blade 15 to 15.5 mm. long, 5.5 to 6 mm. broad. Stamens 10, monadelphous, glabrous. Ovary linear, sessile, densely hairy, 11 or 12-ovulate, 12 mm. long; style slender, glabrous, strongly arcuate, 7 to 7.5 mm. long, ending in a lateral, liguliform stigma.

Legume not known.

Type collected near Chifla, in the vicinity of Puebla, Mexico, by Andrieux (no. 439).

A second collection is from Los Hornos, Michoacán or Guerrero, Mexico, altitude 700 meters, in flower, June, 1899, *Langlassé*.

LONCHOCARPUS OBOVATUS Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 93. 1860.

Of this species I have seen only fragmentary specimens, kindly sent from Kew, consisting of a leaflet, remarkable for its long petiolule and reminding one by

its texture of the genus *Dalbergia*, and a flower which does not give any conclusive evidence except that the wings are apparently free. In the absence of better material, especially of the fruit, the status of this species remains doubtful. The type was collected at Chilla, District of Puebla, Mexico, by Andrieux (no. 440).

LONCHOCARPUS PHASEOLIFOLIUS Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 93. 1860.

Another species of doubtful status, known only from a description of incomplete specimens at Kew. Collected also by Andrieux, near Tehuantepec, Mexico (no. 462).

LONCHOCARPUS PARVIFLORUS Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 89. 1860.

Certainly a good species, according to the description, but unfortunately not found in the material at my disposal. In the key it should be placed near *L. atropurpureus*.

LONCHOCARPUS LITTORALIS T. S. Brandeg. Zoe 5: 157. 1903.

According to Brandege, the only "generic variation is in the calyx, which, instead of being truncate, with very short obsolete teeth, is divided half its length into lanceolate lobes." More important, and, indeed, decisive, as diverging characters, are the dehiscent pods and stipellate leaflets. This plant does not belong in *Lonchocarpus*.

TRANSFERRED SPECIES.

Gliricidia meistophylla (Donn. Smith) Pittier.

Lonchocarpus meistophyllus Donn. Smith, Bot. Gaz. 56: 55. 1913.

This differs from *Lonchocarpus* in the appearance of the leaves and flowers. Moreover, the staminal tube is split, with the vexillar stamen often almost free, and the basal fenestrellæ are either absent or with very thin margins; the calyx is quite aberrant, and the thickened margins of the ovary seem to indicate a dehiscent legume. For these reasons the transfer, as above, is proposed.

Pringle 5649 and 6748, *Rose* 5869 and 9923, and *Purpus* 1187, labeled as *Lonchocarpus*, all have dehiscent pods and stipellate leaflets; they should be placed among the Galegeae, perhaps in or near *Galactia*.

SOUTH AMERICAN AND WEST INDIAN SPECIES.

Many Middle American specimens have been identified as *Lonchocarpus violaceus* Benth., but this name is now found to be untenable. The type of the genus, *L. punctatus* H. B. K., was confused with the supposed *violaceus* by Bentham. To exhibit the distinctive characters of the two and to show how they differ from the Middle American species of the section *Punctati*, they have been included in the above key and are fully described and discussed hereafter.

Among the species collected in Santa Marta, Colombia, by Herbert H. Smith and in Venezuela by J. R. Johnston and the writer some were found to be new, and others to belong to little-known types. Their detailed descriptions are also added to the present paper, as well as that of another species, discovered in Bolivia by H. H. Rusby and belonging to the section *Fasciculati* Benth.

Lonchocarpus benthamianus Pittier.

FIGURE 37.

Lonchocarpus violaceus Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 95. 1860, not H. B. K. 1823.

A small tree, the branchlets, leaves, and rachis of the inflorescences entirely glabrous.

Leaves 7 to 11-foliolate, the rachis subterete, canaliculate on the basal part, 9 to 20 cm. long. Leaflets membranous, pellucid-punctate, the petiolules canaliculate, 6 mm. long, the blades ovate, more or less oblique, rounded at the base, obtusely acuminate, 4 to 9 cm. long, 3 to 4.5 cm. broad, dark green above, paler beneath; costa and veins (8 or 9) rather prominent beneath. Stipules not seen.

Racemes axillary, 15 to 25 cm. long. Peduncles solitary, 6 to 7 mm. long, biflorous, glabrous; pedicels slender, 7 to 8 mm. long, glabrous; bracts and bractlets ovate, suborbicular, minute, ciliate on the margin, very caducous. Calyx broadly cupulate, rounded at the base, truncate, glabrous, more or less glandular-dotted, about 5 mm. long. Petals whitish without, pale purple or pinkish within; standard orbicular, glabrous, about 15.5 mm. long and broad, projecting at the base in a narrow, bilobate, rounded appendage, deeply emarginate at the rounded apex, emarginate on both sides of the basal appendage, this about 3 mm. long and 3.5 mm. broad, the claw strongly arcuate, 2 mm. long, inserted on the back of the appendage; wings obovate, oblique, auriculate, more or less inflexed on the upper margin, the lower margin strongly arcuate, the claw about 5.5 mm. long, the blade rounded-obtuse at the apex, 11.5 mm. long, 6 mm. broad; carinal petals falcate, convex in the middle, broadly rounded at the apex, sparsely pubescent along the lower margin, the claw about 5 mm. long, the blade 9.5 to 10 mm. long. Vexillar stamen free at the base only. Ovary sessile, linear, minutely pubescent, about 9 mm. long, 3 or 4-ovulate; style arcuate, hairy toward the apex.

Legume lanceolate, compressed, suboblique, long-stipitate, subulate-acuminate, 1-seeded, about 6 cm. long and 3 cm. broad, glabrous, the vexillar suture narrowly marginate, the carinal suture thin-edged and broader. Seed reniform, depressed, dark brown, about 15 mm. long and 10 mm. broad.

Type from the West Indies.

SPECIMENS EXAMINED:

GUADELOUPE: *Duss* 2663 (small tree, especially abundant on the cliffs and in stony places close to the seashore at Vieux Fort, Le Baillif, Deshaies, etc., at altitudes from 0 to 400 meters; flowers May to August; common name "savonnette").

MARTINIQUE: *Duss* 1091 (a common tree; delights in the neighborhood of the sea; Case Pilote, Prêcheur; blossoms in July and August; common name "savonnette"). Collines du Bois Brûlé, in fruit, August, 1871, *Hahn* 1123.

BARBADOS: In flower, December, *Waby* 9 (a slender, tall tree, rather common, the flowers pale pinkish). In flower, April to June, 1895, *Waby* 106 (a small tree with white flowers).

The name *Lonchocarpus violaceus* Benth. has no standing under the current rules. As mentioned above (p. 38), when Kunth created the genus he suggested the transfer into it of several species, among them *Robinia violacea* Beauv.¹ This is an African tree, possibly the same as *L. sericeus* (Poir.) H. B. K., or a synonym of *Capassa violacea* Klotzsch² and *L. philenoptera* Benth.,³ but certainly not the same as *Robinia*



FIG. 37.—*Lonchocarpus benthamianus*.
a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil.
Natural size. From *Duss* 2663.

¹ H. B. K. Nov. Gen. & Sp. 6: 383. 1823.

² In Peters, Reise Mossamb. Bot. 28. pl. 5. 1862.

³ App. Speke's Journ. 632. 1863.

violacea Jacq. from Cartagena. Though Kunth did not actually designate the former species as *Lonchocarpus violaceus*, he obviously indicated the convenience of doing so. On the other hand, the identity of the plant from Cartagena, described by Jacquin, with the West Indian species to which Benthams name was applied is by no means certain, since the former is described as having 3 or 4-foliolate leaves, short pedicels, flowers with the color and scent of the violet, and diadelphous stamens,¹ all characters conspicuously absent in the latter. Hence the name *Lonchocarpus violaceus* as applied by Benthams must be discarded, first, because it is manifestly a synonym and, second, because Benthams plant is neither of the species originally designated as *Robinia violacea*. As to *Robinia sepium* Swartz,² it is described as a shrub or small tree often 20 feet high, with 3-foliolate leaves, a bilabiate, 5-toothed calyx, and a lanceolate ovary, all characters which are not found in Benthams plant. Lastly, I expect to show that *Lonchocarpus punctatus* H. B. K. is a distinct species. Many other forms which appear in our American collections under the name of *L. violaceus* do not belong there.

As understood here, *L. benthamianus* has a very reduced area of distribution, being found, so far as is known, only in Martinique, Guadeloupe, Barbados, and Montserrat. It probably occurs in the intermediate islands also.

***Lonchocarpus punctatus* H. B. K. Nov. Gen. & Sp. 6: 383. 1823. FIGURE 38.**

A tree, the branchlets terete, grayish, glabrous, lenticellate.

Leaves mostly 7-foliolate, sometimes 5 or 9-foliolate, entirely glabrous, the rachis slender, subterete, more or less distinctly canaliculate, 7 to 12 cm. long. Leaflets sub-

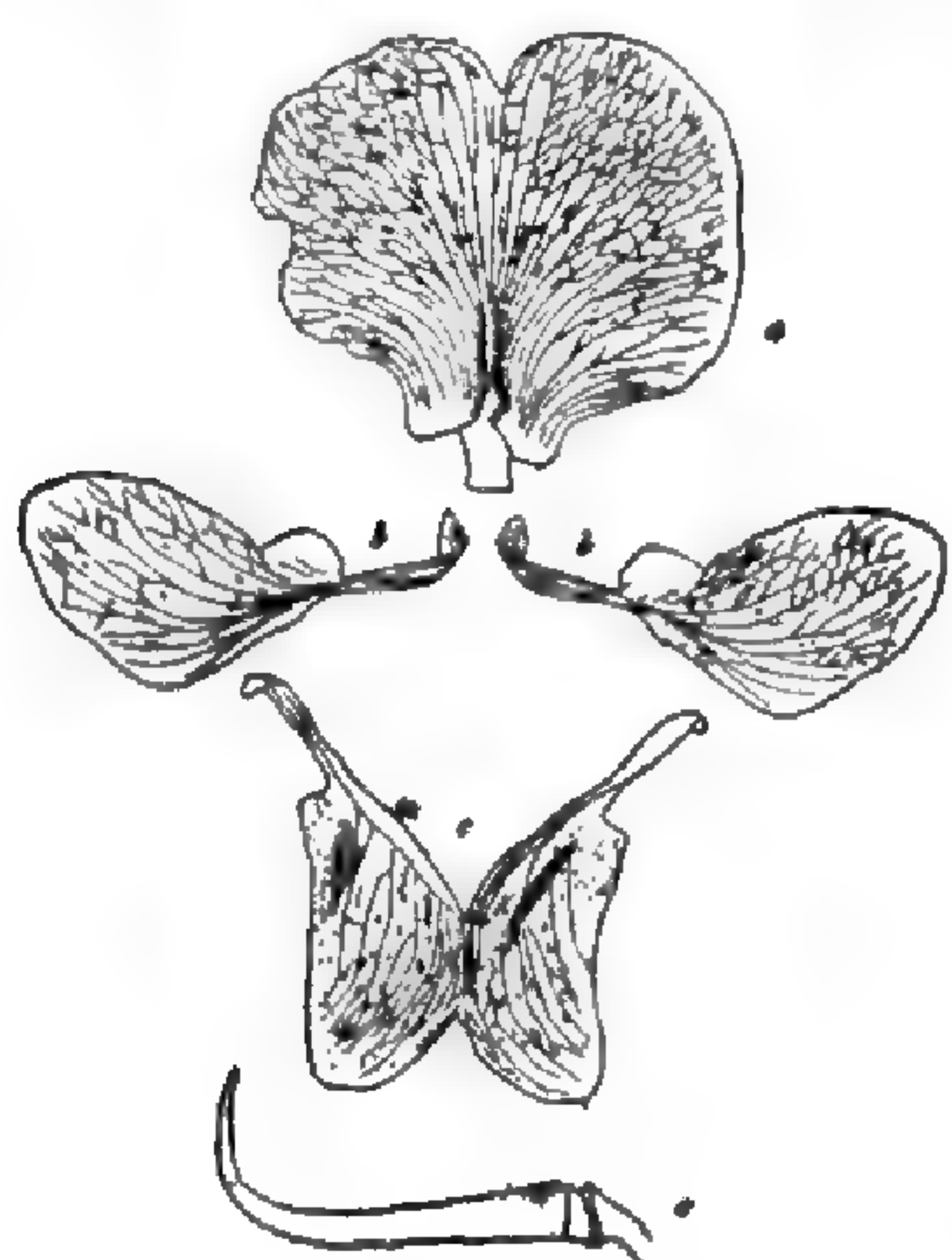


FIG. 38.—*Lonchocarpus punctatus*.
a, Standard; b, wings; c, carinal petals; e, pistil. Natural size.
From Johnston 22.

coriaceous, petiolulate, densely pellucid-punctate, the dots appearing (with or without lens) as black spots on the faces of the blade; petiolules glabrous, canaliculate, 4 mm. long; blades ovate-oblong, rounded at the base, obtusely acuminate at the apex, minutely reticulate, 3 to 5 cm. long, 1.5 to 3.8 cm. broad, light green and subglabrous above, paler beneath. Stipules not seen.

Racemes axillary, paniculate at the ends of the branchlets, the flowers sweet-scented, the rachis glabrous, more or less angulate, 7 to 16 cm. long. Peduncles and pedicels glabrous, the former biflorous, 4 to 8 mm. long, the latter about 6 mm. long; bracts and bractlets very small, ovate, ciliate. Calyx broadly cupulate, usually truncate, sometimes subdentate, glabrous, 4.5 to 5 mm. long, more or less spotted (when seen against the light). Petals reddish pink, covered with numerous glandular dots (visible under the lens only); standard suborbicular, concave, bilobulate at the base, deeply emarginate at the apex, the claw inserted on the back of the basal lobules, about 2.8 mm. long, the blade pubescent without above the insertion of the claw, marked at the base with a large dark purple spot, 12 to 13 mm. long, about 15.5 mm. broad; wings obovate, very oblique, auriculate at the base on the vexillar side, obtuse at the apex, the claw about 5 mm. long, the blade 10.5 to 11 mm. long, 6 mm. broad, slightly pubescent at the apex; carinal petals falcate, subauriculate on the vexillar margin, more or less pubescent without, the claw 4.5 mm. long, the blade convex near the base, 9.5 to 10 mm. long, 4 to 5 mm. broad. Vexillar stamen free at the base. Ovary sessile, linear, puberulous at the base, elsewhere glabrous, about 8.5 mm. long, 7 to 9-ovulate; style arcuate, hairy at the base and along the carinal side up to 1 mm. from the apex; stigma ligulate, very small.

Legume not known.

Type from Cumaná, Venezuela, collected by Humboldt and Bonpland.

¹ Jacq. Stirp. Amer. 210. pl. 177. f. 49. 1763.

² Fl. Ind. Occ. 1258. 1806.

The specimens examined are *Johnston* 22 and *Johnston & Miller* 257, collected at El Valle, Island of Margarita, Venezuela, in July and August, 1901.

This species is the type of the genus *Lonchocarpus*. It differs strikingly from *L. benthamianus*, of the West Indies, in the size of the leaves, the number, shape, and size of the leaflets, the coloration of the petals, the indument of the pistil, the number of the ovules, and several minor details. The transparent dots of the leaflets extend to the petals and on the former are conspicuous on the surface as minute black spots. The dark spot at the base of the standard, quite visible in dry specimens, is also a good distinctive character.

Margarita Island lies very close to the coast of Paria, and not far from Cumaná, the type locality of the species. Notwithstanding slight discrepancies in the details, there can hardly be a doubt as to the identity of the specimens described above with the tree reported by Bonpland. Like that of *L. benthamianus*, the distributional area of this species seems to be very restricted. The tree has been reported from other parts of Venezuela under the vernacular name "aco," which, however, may apply to several species.

***Lonchocarpus densiflorus moritzianus* Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 100. 1860.** FIGURE 39.

Section *Densiflori*. A deciduous tree, the branchlets stout, grayish, glabrous.

Leaves 7-foliolate, the rachis broadly canaliculate (the channel aristate at the bottom), glabrous, 17 to 25 cm. long. Leaflets coriaceous, the petiolules thick, 6 mm. long, canaliculate, sparsely pubescent or glabrescent, the blades ovate or oblong, broadly rounded at the base, obtuse-acuminate at the apex, 8 to 16 cm. long, 5 to 6.5 cm. broad, dark green, glabrous, and more or less lustrous above, paler and glabrescent or sparsely pilosulous (on the costa principally) beneath; costa and veins slightly prominent on both sides.

Racemes axillary on the defoliate nodes, the rachis mostly thick, arcuate, rigid, about 18 cm. long, ferruginous or grayish-pubescent. Peduncles fasciculate, simple, pubescent, 3 to 5 mm. long; bracts oblong, pubescent, sinuate on the margin, up to 4 mm. long, early deciduous; bractlets ovate or suborbicular, about 1 mm. long, scarious, pubescent, appressed to the calyx, caducous. Calyx broadly cupulate, sinuate-toothed, 5.5 to 6 mm. long, minutely pubescent, purplish, more or less distinctly pale-striped longitudinally. Petals purple, shading to white toward the base; standard orbicular, emarginate and prominently callous-plicate at the base, concave, broadly rounded and slightly emarginate at the apex, densely white-spotted, softly pubescent without, the claw 4.5 mm. long, the blade about 12 mm. long and 14 mm. broad; wings strongly arcuate-falcate, auriculate, sparsely white-spotted, glabrous or slightly pubescent; carinal petals falcate, concavo-convex and bulging toward the outside at the base, subauriculate, subobtusate at the apex, densely gray-pubescent along the keel, the carinal margin strongly arcuate, the claw 6 mm. long, the blade about 14 mm. long and 6.5 mm. broad. Staminal tube glabrous, slightly dilated and the vexillar stamen narrow at the base, the fenestrellæ narrowing in a V-form at the apex. Ovary linear, stipitate, arcuate, gray-pubescent, about 12 mm. long, 8-ovulate; style slightly arcuate, sparsely pubescent throughout; stigma capitellate, ovoid, elongate.

Legume not known.

Type, *Moritz* 880, from Colombia, without precise locality; presumably in the Kew Herbarium.

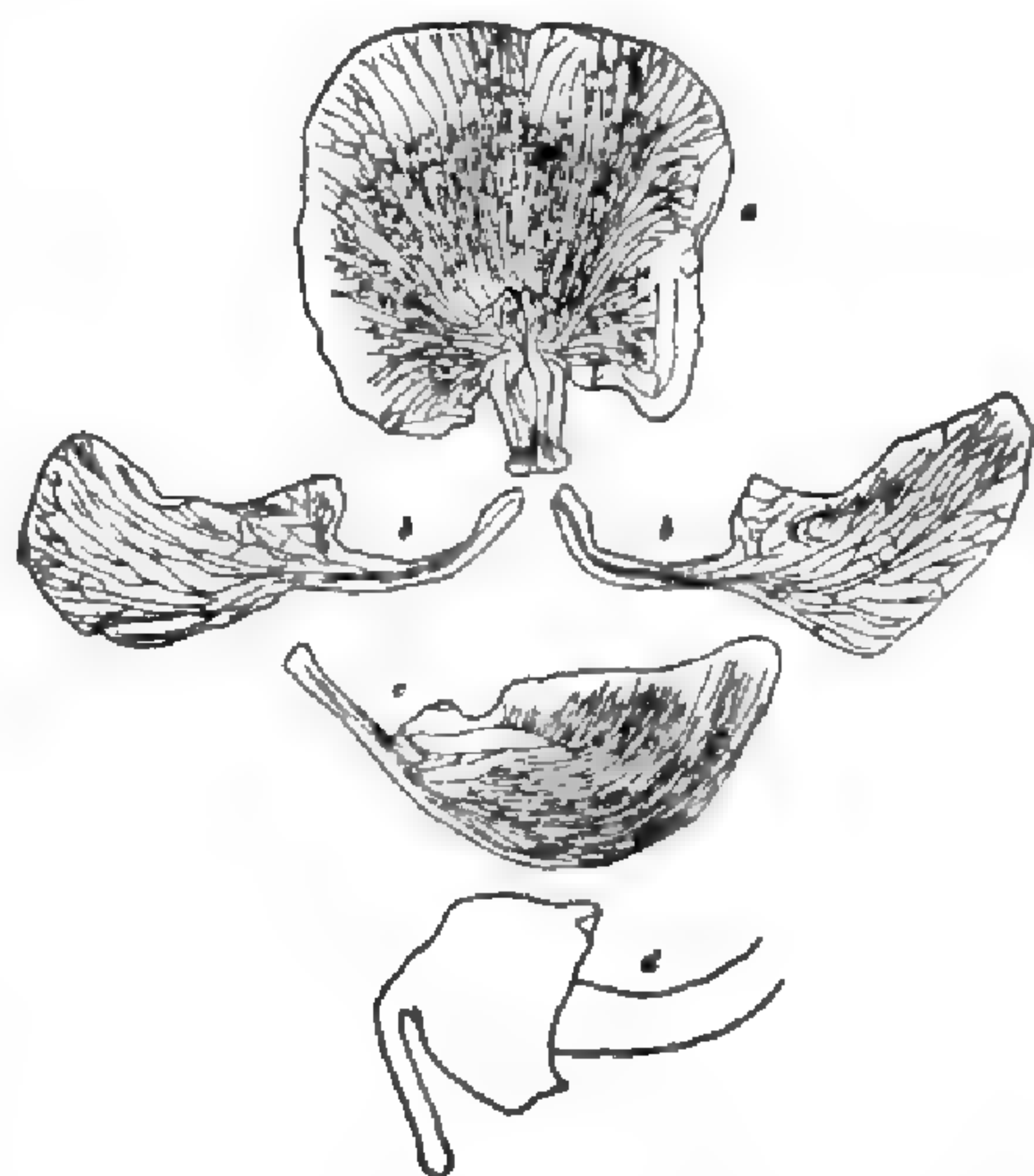


FIG. 39.—*Lonchocarpus densiflorus moritzianus*. a, Standard; b, wings; c, carinal petals; d, calyx. Natural size. From *Pittier* 5805.

Additional specimens were collected between Mariara and Antequera, State of Aragua, Venezuela, altitude about 600 meters, in flower, February 5, 1913, by H. Pittier (no. 5805).

A striking tree, growing in the open or parklike country and completely leafless at flowering time. I obtained only an imperfect specimen, this accounting for the deficiencies in the description of the flower.

***Lonchocarpus dipteroneurus* Pittier, sp. nov.**

Subgenus *Neuroscapha*. A small tree, the branchlets glabrous, grayish brown, minutely and densely lenticellate.

Leaves 13 or 15-foliolate, the rachis slender, canaliculate, glabrous or minutely pilosulous, 7 to 11.5 cm. long. Leaflets coriaceous, oblique, the petiolules canaliculate, about 2 mm. long, pilosulous, the blades ovate or lanceolate, rounded and ultimately often subattenuate at the base, more or less obtusely attenuate-acuminate at the apex, 3 to 6 cm. long, 1 to 3 cm. broad, dull green and glabrous above, paler and sparsely pubescent beneath, the costa and veins slightly prominent and pilosulous on both faces.

Flowers not known.

Legume ovate-lanceolate, more or less concavo-convex, strongly arcuate on the carinal side, long-stipitate, arcuate-rostrate at the apex, glabrous, either 1-seeded, then about 5 cm. long and 2.5 cm. broad, or 2-seeded, then strongly contracted between the seeds and up to 7 cm. long; carinal margin thin-edged; vexillar margin concave opposite the seeds, about 5 mm. broad, each side broadly winged. Seeds oblong, subcylindrical, subreniform, about 6 mm. long, 12 mm. broad, light brown.

Type in the U. S. National Herbarium, nos. 601697 and 601698, collected on the Guinand Estate (Cárdenas), Siquire Valley, State of Miranda, Venezuela, at an altitude of about 600 meters, in fruit, March, 1913, by H. Pittier (no. 5978).

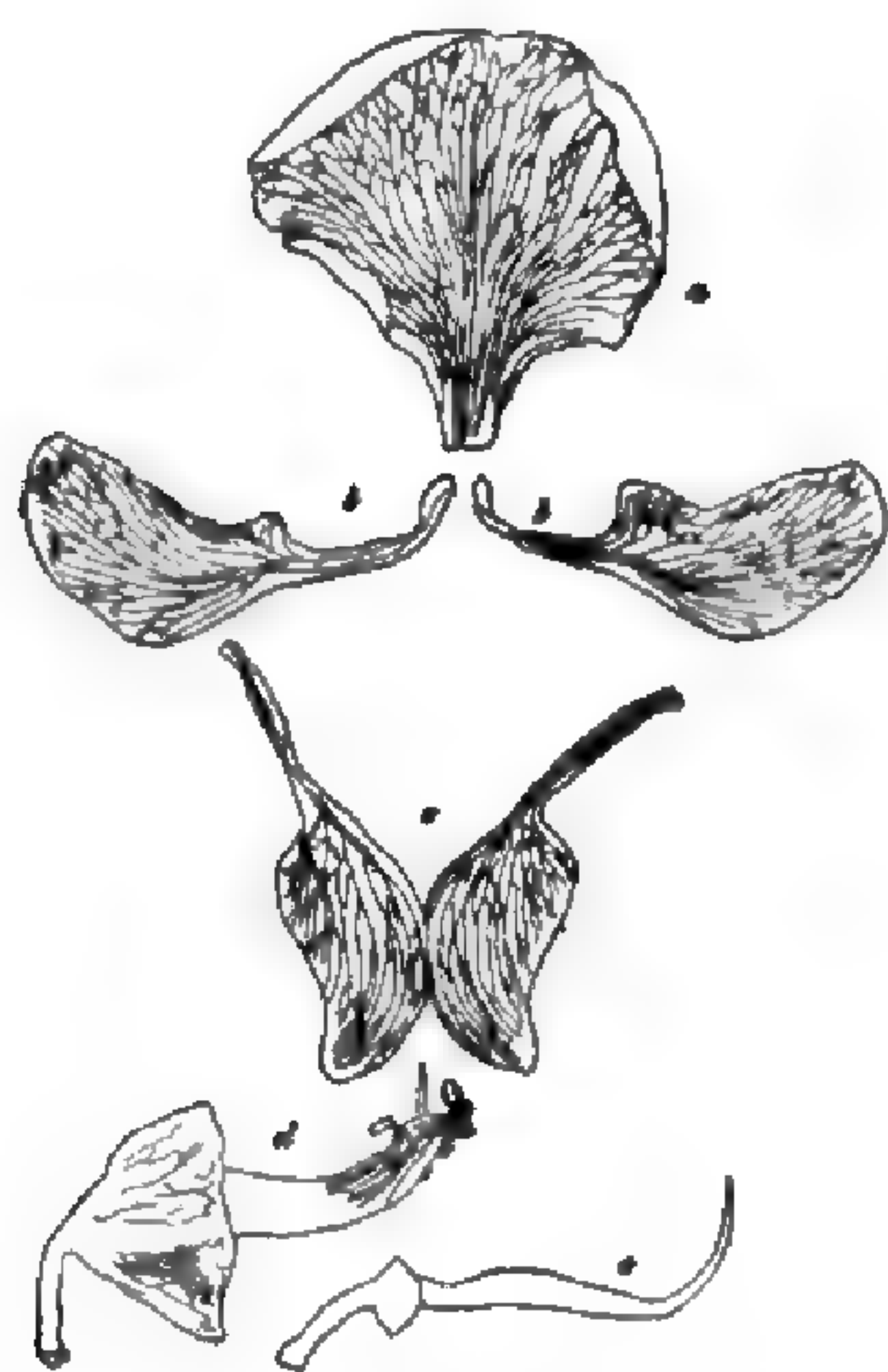


FIG. 40.—*Lonchocarpus fendleri*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Pittier 6045.

Known among the natives under the name of "grifo," this species is distinct from any of those seen by me. It evidently belongs to the subgenus *Neuroscapha*, but the fruits are remarkable on account of their shape and of the strongly developed double wing on the vexillar margin.

***Lonchocarpus fendleri* Benth. Journ. Proc. Linn. Soc. Bot. 4: Suppl. 94. 1860.**

FIGURE 40.

A deciduous tree 4 to 12 meters high, with depressed crown, the branchlets grayish, lenticellate, at first canescent-tomentellous.

Leaves 7 to 13-foliolate, appearing with the flowers, the rachis terete or subcanaliculate, 3.5 to 9 cm. long, at first tomentose, later ferruginous-pubescent. Leaflets ovate-oblong or obovate, rounded or cuneate at the base, obtuse or subacute at the apex, 3.5 to 9 cm. long, 2 to 4 cm. broad, at first membranous, glabrous and dark green above, the costa and veins pilosulous, softly tomentose beneath, later coriaceous, glabrous and lustrous above, the costa and veins impressed, beneath paler, more or less rufous-tomentose, the costa and veins prominent.

Racemes axillary, the rachis gray-pubescent, about 14 cm. long or shorter. Peduncles geminate, simple, about 6 mm. long, gray-pubescent; bracts and bractlets elongate-oblong, hardly 1 mm. long, tomentose without, the latter solitary (?) and close to the calyx. Calyx subturbinate-campanulate, obsoletely 5-toothed, about 5 mm. long, gray-pubescent without. Petals pinkish purple; standard orbicular, smooth and attenuate at the base, emarginate at the apex, sparsely pubescent without, the

claw 2.5 to 3.5 mm. long, the blade about 8.5 mm. long and 11 mm. broad; wings oblong, subfalcate, auriculate, obtuse, glabrous or sparsely pilosulous without, the claw 5 mm. long, the blade about 9 mm. long, 3.5 mm. broad; wings falcate, auriculate, obtuse and narrow at the apex, the claw 5.5 mm. long, the blade 8 mm. long, 3.5 mm. broad. Staminal tube not dilated at the base, the openings narrow, gradually closing toward the apex, the filaments alternately long and short, the anthers ovate, sparsely setulous at the base. Ovary linear, stipitate, densely grayish-pubescent, about 8 mm. long, 6-ovulate; style arcuate, glabrous; stigma inconspicuous.

Legume coriaceous, stipitate, more or less ferruginous-velvety, 1-seeded, lanceolate-acuminate, about 8 cm. long and 2 cm. broad, or sometimes 2 to 4-seeded, up to 12 cm. long and 2 cm. broad. Seeds broadly reniform, flattened, about 11 mm. broad, light brown with white hilum.

The type (in Kew Herbarium) was collected at Colonia Tovar, Venezuela, by A. Fendler (no. 2219¹, flowers, 1863², fruits).

SPECIMENS EXAMINED:

VENEZUELA: La Trinidad de Maracay, Aragua, in light forest, alt. about 440 meters, in flower, April 17, 1913, *Pittier* 6045; in fruit, February 3, 1913, *Pittier* 5803. Colonia Tovar, *Fendler* 1863² (a duplicate of the type specimen, Gray Herb.). Mariara, Aragua, in fruit, February 5, 1913, *Pittier* 5804.

Bentham placed this species among his *Eriophylli* and suggested also that it may come near *Lonchocarpus rugosus*, among the *Densiflori*. It is, however, fundamentally distinct on account of the unbranched peduncles, the shape of the basal openings of the staminal tube, and the setulous anthers.

***Lonchocarpus fendleri pubescens* Pittier, subsp. nov.**

A deciduous tree about 15 meters high, the trunk straight, the crown depressed. Leaves 7-foliolate, imperfectly developed at flowering time. Leaflets oblong, obtuse, glabrous above, minutely but densely pubescent beneath. Floral spikes intensely purple, the calyx and petals also purple.

Type in the U. S. National Herbarium, no. 601779, collected in the valley of El Limón, near Maracay, Aragua, Venezuela, in forests, flowers, April 18, 1913, by H. Pittier (no. 6052).

At Maracay, *Lonchocarpus fendleri* was known under the name of "mahomo" or "majomo," but at Mariara, not far distant, it was pointed out to me as the "mijagua" or "mijao," which is also the current appellation for *Anacardium rhinocarpus*.

***Lonchocarpus margaritensis* Pittier, sp. nov. FIGURE 41.**

A tree or a shrub, the branchlets brownish, lenticellate, at first puberulous.

Leaves 7-foliolate, the rachis slightly canaliculate, shortly ferruginous-hairy, 10 to 12 cm. long. Leaflets subcoriaceous, petiolules about 4 mm. long, densely brown-hairy, the blades ovate or oblong, rounded or subcuneate-attenuate at the base, acute and mucronulate at the apex, 2.5 to 9.5 cm. long, 2.8 to 3.2 cm. broad, puberulous and light green above, paler, reticulate, and softly pubescent beneath, the costa and veins immersed above, prominent beneath. Stipules triangular, apiculate, ferruginous-pubescent, about 5 mm. long, early deciduous.

Racemes axillary, subpaniculate at the ends of the branchlets, the rachis ferruginous-hairy, 3 to 7.5 cm. long. Peduncles and pedicels pubescent, the former not over 1 mm. long, the latter 2 to 2.5 mm. long; bracts and bractlets linear, hairy, about

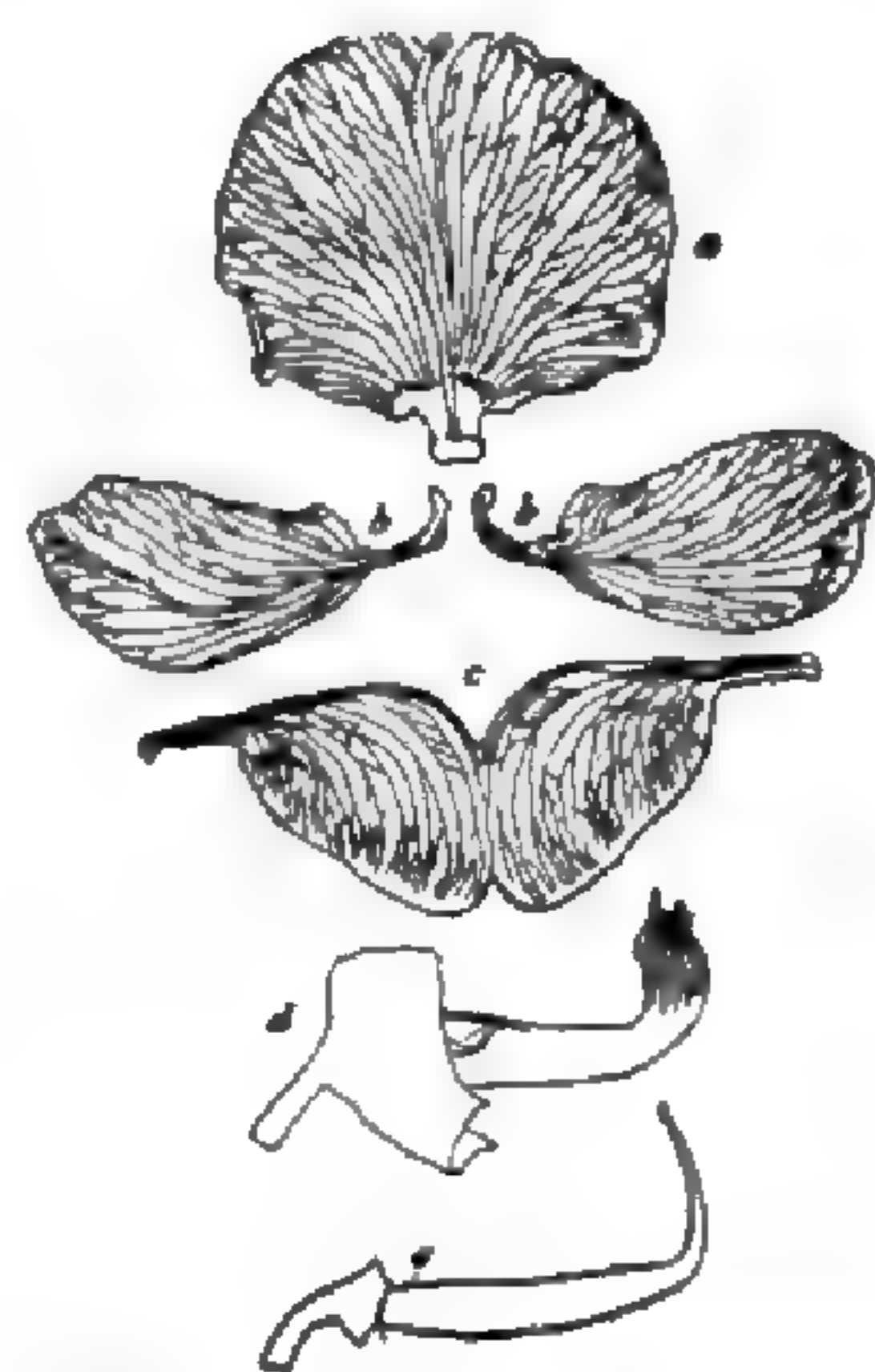


FIG. 41. — *Lonchocarpus margaritensis*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Johnston 23.

2 mm. long, early caducous. Calyx cupulate, sinuate-toothed, 3 to 4 mm. long, minutely pubescent without. Petals pink; standard suborbicular, callous-plicate at the base, emarginate at the apex, minutely pubescent without, barbate at the base within, the claw about 1.5 mm. long, the blade 10 mm. long, 12 mm. broad; wings oblique, broadly obovate, slightly winged, obtuse, sparsely pilosulous at the base of the blade without, the claw about 3 mm. long, the blade 8.5 mm. long, 5 mm. broad; carinal petals falcate, broad, obtuse, densely pubescent without, the claw 2.5 mm. long, the blade about 8 mm. long, 5 mm. broad. Staminal tube glabrous, the filaments alternately short and long. Ovary linear, stipitate, densely cano-pubescent, about 7 mm. long, 4-ovulate; style very long (nearly 5 mm.), geniculate, sparsely ciliate on the inside; stigma subglobose, capitellate.

Legume subchartaceous, lanceolate, stipitate, acuminate and mucronate at the apex, about 9 cm. long, 2.6 cm. broad, 1-seeded, pale brown, pubescent. Seed reniform, compressed, about 6.5 mm. long, 11 mm. broad, dark brown.

Type in the herbarium of the New York Botanical Garden, collected at El Valle, island of Margarita, Venezuela, flowers and detached fruits, July 7, 1903, by J. R. Johnston (no. 23).

Distributed as *L. velutinus* Benth., but very distinct, especially as to floral characters, and related probably to the species of the section Spongopteri.

***Lonchocarpus sanctae-marthae* Pittier, sp. nov.**

PLATE 1, D (facing p. 54). FIGURE 42.

Section Paniculati. A deciduous, spreading tree 10 to 15 meters high, the branchlets grayish, glabrous, covered with inconspicuous lenticels.

Leaves 5 to 9- (mostly 7-) foliolate, glabrous (pubescent at the earliest stage), the rachis obscurely canaliculate, 6 to 14 cm. long. Leaflets membranous, the petiolules slightly canaliculate, 4 to 5 cm. long, the blades ovate or oblong, rounded or broadly cuneate at the base, obtusely subacuminate at the apex, 3.5 to 11 cm. long, 2 to 5 cm. broad, minutely reticulate on both faces, light green above, paler or glaucescent beneath, the costa and veins prominent.

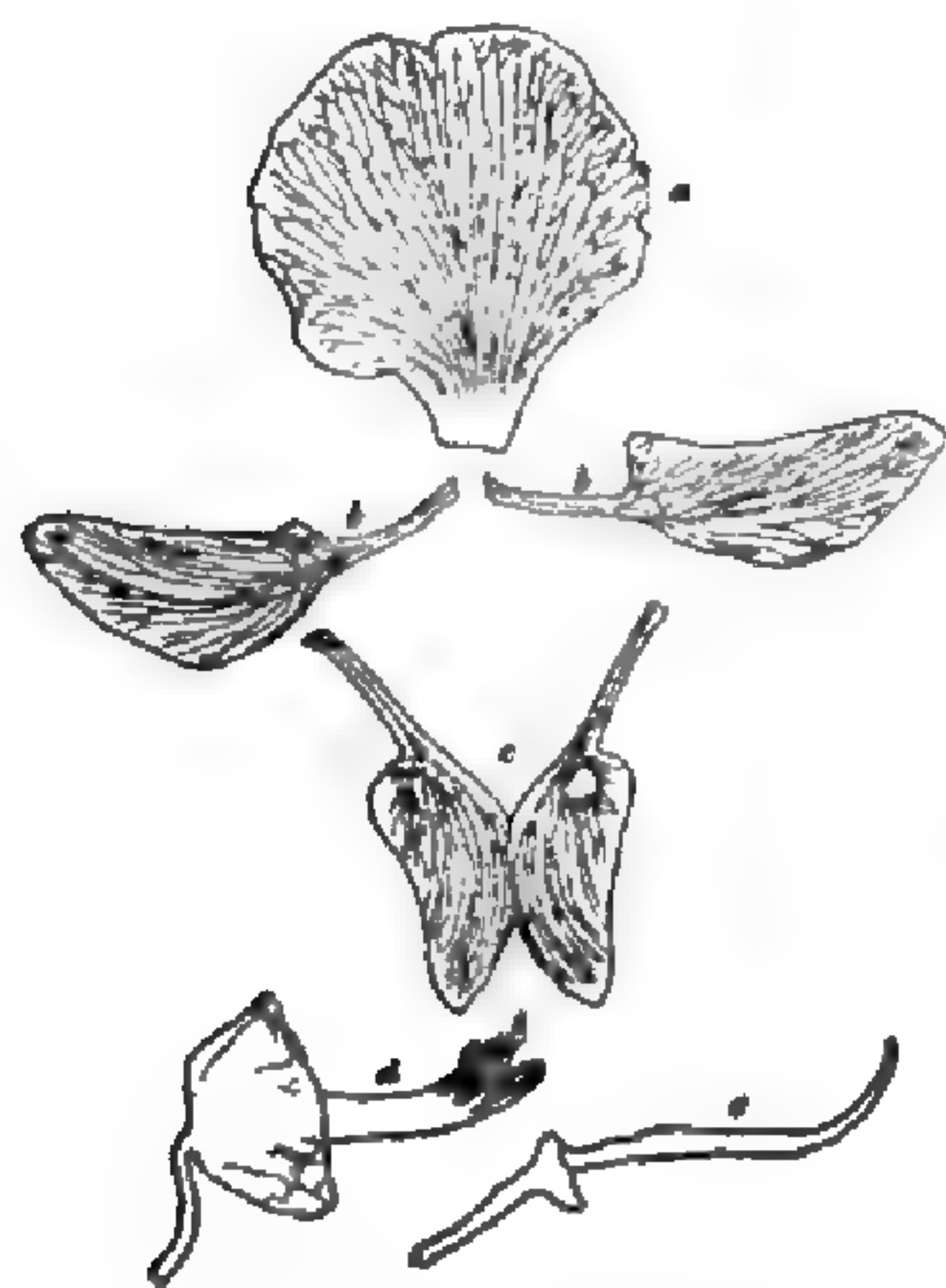


FIG. 42.—*Lonchocarpus sanctae-marthae*. a, Standard; b, wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From H. H. Smith 107.

Racemes axillary (mostly on defoliate nodes), subpaniculate at the ends of the branchlets, the rachis angular, puberulous or pubescent, 4 to 14 cm. long. Pedicels simple, often geminate, 3 to 6 mm. long, sparsely pubescent; bracts and bractlets very small and deciduous, oblong, pubescent, the latter distant from the calyx. Calyx broadly cupulate, about 4 mm. long, minutely and sparsely pubescent, purplish, the margin sinuate and irregularly short-ciliate. Petals pink; standard orbicular, broadly attenuate at the base, emarginate and pubescent at the apex, the claw about 2 mm. long and broad, the blade 10 mm. long, 11.5 mm. broad; wings oblique, narrow, auriculate, obtuse, callous, concavo-convex and bulging out at the base, sparsely pilosulous without, the claw 4 mm. long, the blade about 9 mm. long, 3.5 to 4 mm. broad; carinal petals falcate, callous, concavo-convex and bulging out at the base, auriculate, subobtuse, slightly pubescent without and ciliate at the apex, the claw 4.5 to 5 mm. long, the blade 7.5 mm. long, 3 to 3.5 mm. broad. Staminal tube almost straight, glabrous, the anthers hairy at the base. Ovary linear, stipitate, minutely pubescent, about 7 mm. long, 6-ovulate; style slightly arcuate, sparsely pubescent at the base; stigma bilobulate, inconspicuous.

Legume ovate-lanceolate or elongate, stipitate, acute or obtuse at the apex, submembranous, glabrous, rounded on the margins, either 1-seeded and 4 to 4.5 cm. long,

or 2-seeded and 8 cm. long, 1.6 cm. broad across the seeds. Seeds broadly reniform, about 6 mm. long and 8 mm. broad, flat, reddish brown with a light-colored hilum.

Type in the U. S. National Herbarium, no. 600294, collected in dry forest near Mamatoca, at the foot of the Cordillera de Santa Marta, Colombia, altitude about 30 meters, flowers, April 10, 1899, by Herbert H. Smith (no. 107).

This beautiful species was distributed under the name of *Lonchocarpus sericeus* (Poir.) H. B. K. A look at the floral racemes shows the simple pedicels, and the pods evidently are not those characterizing the subgenus *Neuroscapha*, to which the latter belongs. On the other hand, the Santa Marta tree does not seem to correspond to any of the species with simple peduncles heretofore described.

Under the same number, three distinct collections have been distributed, obtained February 25, April 10, and August 19, 1899. A note by Mr. Smith on one of the New York Herbarium sheets explains that "this species seems to be rare, flowering principally from February to April. In April, the flowering branches were nearly leafless but the rest of the tree was covered with old and young leaves."

EXPLANATION OF PLATE 1.—See p. 54.

***Lonchocarpus boliviensis* Pittier, sp. nov.**

FIGURE 43.

Section *Fasciculati*. A tree or a shrub (?), the branchlets terete, glabrous, obscurely lenticellate.

Leaves 7 or 9-foliolate, the rachis slender, thickened and darker at the base, canaliculate, sparsely pilosulous or glabrescent, 9 to 12 cm. long. Leaflets coriaceous, the petiolules canaliculate, glabrous or sparsely pubescent, 4 to 5 mm. long, the blades oval-elliptic or elliptic-lanceolate, acute or slightly rounded at the base, acute-acuminate and mucronulate at the apex, 2.5 to 7 cm. long, 1.3 to 2.7 cm. broad, dark green, sublustrous, and, except on the impressed costa, glabrous above, paler (or subglaucous), reticulate, and minutely pubescent beneath, the costa and veins subglabrous and prominent. Stipules ovate, acute, pubescent, 3 to 4 mm. long, caducous.

Racemes axillary, the rachis thick, angular, more or less rufous-pubescent, 15 to 30 cm. long, the flowers fasciculate on thick, short peduncles. Pedicels simple, 3 to 5 mm. long, sparsely pubescent; bracts and bractlets suborbicular, about 1 mm. in diameter, densely rufous-pubescent, caducous. Calyx broadly cupulate, sinuate on the margin, about 4 mm. long, densely ferruginous-pubescent without. Petals purplish; standard subflabellate, attenuate at the base into a short claw, emarginate at the apex, about 11 mm. long (without the claw, this 1 mm. long) and 13 mm. broad, minutely dark-punctate, pubescent without; wings narrow, arcuate, long-attenuate at the base, obtuse and subbilobulate at the apex, sparsely pubescent without, ciliate on the lower margin at the base, the claw 4 to 5 mm. long, the blade about 15 mm. long and 3.5 mm. broad; carinal petals strongly falcate, attenuate at the base, acute at the apex, sparsely pubescent along the lower margin without, the claw 1 mm. long, the blade about 11.5 mm. long, 4 to 4.5 mm. broad. Staminal tube strongly arcuate, slightly hairy on the upper side. Ovary short-stipitate, linear, minutely pubescent, about 7 mm. long, 16 to 18-ovulate; style long, filiform, broadly arcuate, sparsely hairy; stigma capitellate, minutely hairy.

Fruit not known.

Type in the U. S. National Herbarium, no. 32680, collected at the junction of the rivers Beni and Madre de Dios, Bolivia, in August, 1886, by H. H. Rusby (no. 2362).

This species differs from all the others in the section *Fasciculati* in its numerous ovules.



FIG. 43. — *Lonchocarpus boliviensis*. b, Wings; c, carinal petals; d, calyx and stamens; e, pistil. Natural size. From Rusby 2362.

NEW OR NOTEWORTHY PLANTS FROM COLOMBIA AND CENTRAL AMERICA—7.¹

By HENRY PITTIER.

INTRODUCTION.

In this seventh number of the series the author as usual presents descriptions of new and old species in several families. The only group treatment is that of the Artocarpoideae-Brosimeae of the family Moraceae, in which the genera *Piratinera* and *Brosimum* are redescribed as distinct and their species listed with description where needed.

MORACEAE.

THREE NEW SPECIES OF *HELICOSTYLIS*.

Helicostylis latifolia Pittier, sp. nov.¹

A middle-sized, laticiferous forest tree, 20 to 25 meters high, the trunk 30 to 40 cm. in diameter at the base. Bark rugose, lenticellate, 8 to 12 mm. thick, grayish. Main limbs ascending, the branchlets divaricate and subhorizontal. Crown globose or elongate.

Leaves of medium size, coriaceous, glabrous; petioles 4 to 7 mm. long, canaliculate, dark brown; blades broadly ovate or obovate, 4 to 9 cm. long, 3 to 5 cm. broad, subacute at the base, shortly acute-acuminate at the apex, light green above, subglaucous beneath; nervation brownish, impressed above, prominent beneath, the costa thick, the 13 to 15 primary veins almost perpendicular to it; margin obscurely revolute. Stipules lanceolate, acute, about 4 mm. long, caducous.

Male receptacles globose, solitary or geminate in the axils of the leaves, short-pedunculate, surrounded in estivation by a basal involucre of 4 or 5 ovate bracts about 0.5 cm. long; peduncles 4 to 5 mm. long, glabrous. Bractlets on the surface of the receptacle orbicular, peltate, hairy and ciliate, the largest 1.5 mm. in diameter. Perianth divisions 4, broadly ovate or obovate, hairy, ciliate. Stamens 0.8 to 2 mm. long; anther cells 2, transverse to the filaments and splitting almost as in *Brosimum alicastrum*. Female flowers not seen.

Fruit unknown.

Type in the U. S. National Herbarium, no. 678535, collected in the dry forest hills around Alhajuela, Chagres Valley, Canal Zone, Panama, male flowers only, May 12, 1911, by H. Pittier (no. 3488).

¹No. 6 of this series will be found in volume 18 of the Contributions, pp. 225-259.

There are the following other collections:

PANAMA: Hilly forests around Yaviza, southern Darién, male flowers, April 23, 1914, *Pittier* 6584. Forests around Pinogana, southern Darién, young shoots and leaves, April, 1914, *Pittier* 6696.

***Helicostylis montana* Pittier, sp. nov.**

A large, deciduous tree, 25 to 30 meters high, the trunk 80 to 100 cm. in diameter at the base. Bark grayish, smooth. Primary limbs ascending. Crown elongate.

Leaves alternate, coriaceous, glabrous, petiolate; petioles terete, 5 to 10 mm. long, minutely pubescent; blades elliptic-lanceolate, suboblique, obtuse at the base, long and acutely acuminate at the apex, 8 to 14 cm. long, 2 to 4 cm. broad, glabrous and lustrous above, more or less pubescent beneath; nervation prominulous, the costa impressed above, very prominent beneath; primary veins about 15, arcuate, anastomosed along the margin, this entire and more or less revolute. Stipules not seen.

Male receptacles globose, axillary, about 12 mm. in diameter, the peduncles slender, 8 to 10 mm. long, pubescent; interstaminal bractlets orbicular-spatulate, hairy, ciliate, 10 to 15 mm. long. Perianth divisions 4, free from the base, obovate, conchoid, more or less attenuate, about 2 mm. long, sparsely hairy and ciliate on the upper margin. Stamens 4, exserted, about 3.5 mm. long; filaments slender, united at the base; anthers oblong, sagittate at the base, more or less apiculate at the tip. Female flowers not seen.

Fruit unknown.

Type in the U. S. National Herbarium, no. 715650, collected at Paso de Quebrada Gata, in the mountains of the San Felix Valley, Panama, at an altitude of 485 meters, male flowers only, December 28, 1911, by H. Pittier (no. 5426).

***Helicostylis bolivarensis* Pittier, sp. nov.**

A tree. Branchlets short, slender, grayish, glabrous.

Leaves coriaceous, stiff, petiolate; petioles canaliculate, 3 mm. long, pubescent; blades ovate-elliptic, attenuate and rounded at the base, acutely short-acuminate at the apex, 3 to 8 cm. long, 2 to 4 cm. broad, above glabrous or puberulous, the venation prominulous, beneath paler and puberulous, the venation prominent; primary veins 12 to 14, conspicuously arcuate-anastomosed along the margins. Stipules acute-lanceolate, about 6 mm. long, pubescent, caducous.

Male inflorescence not known. Female flowers solitary in the axils of the leaves, subsessile, pubescent, the receptacle globose, scaly. Style about 5 mm. long, persistent, dividing at the apex into 2 short, thick stigmatic branches. Other details not known.

Fruit globose, 12 to 14 mm. in diameter, 1-seeded.

Type in the U. S. National Herbarium, no. 537446, collected in the vicinity of Estrella, Department of Bolivar, Colombia, female flowers and fruits, May, 1916, by H. M. Curran (no. 304).

THE GENERA *PIRATINERA* AND *BROSIMUM*.

Following Poeppig and Endlicher,¹ most modern botanists have considered *Piratinera guianensis* Aubl.,² not as the type of a well-founded genus, but as a member of the genus *Brosimum*, established by Swartz in 1788,³ on his *Brosimum alicastrum*, the breadnut of

¹ Nov. Gen. & Sp. 2: 34. pl. 148. f. a-d. 1838.

² Pl. Gulan. 2: 888. pl. 340. 1775.

³ Prodr. Veg. Ind. Occ. 12. 1788.

Jamaica. If we admit that these two species are really congeneric, we must concede also the priority to *Piratinera* and transfer all species of *Brosimum* under that name. This was the view adopted by Coville and Wight in their revision of botanical nomenclature for the Century Dictionary, edition of 1909-11. On the other hand, Huber,¹ also trying to be consistent with the rules of nomenclature, reestablished the specific name of the Guiana tree as *Brosimum guianense* (Aubl.), supposing at the same time that the Amazon species he had in view was identical with the one from French Guiana, an assumption which, as we shall see, can not be sustained.

In the following paragraphs evidence is given tending to prove that *Piratinera* and *Brosimum* are in reality distinct and well-founded genera, and an attempt is made to straighten out the almost hopeless confusion brought about by the unjustified endeavor to keep them under a single head.

COMPARISON OF CHARACTERS.

The fundamental characters of the genus *Brosimum* as established by Swartz are: "Flowers without a perianth, the male numerous, 1-staminate, the female solitary in each inflorescence, this consisting of a globose receptacle covered with peltate scales." It is evident from Aublet's description that his plant has no place under *Brosimum*, even though there are contradictions between the Latin diagnosis and the description in French that follows.

In the former Aublet describes the inflorescences as "axillares, pedunculati, *globosi*, solitarii vel bini, virescentes." The word "globosi" seems to point to a globose receptacle, like that of *Brosimum*; but reading further we see that "le bouton de fleurs est singulier, *il est en cône par sa base, arrondi et convexe à son sommet, qui est couvert d'un nombre considérable de petits corps en forme de champignons.*" The italicized expressions in the French text clearly indicate that in *Piratinera* the receptacle is not globose but turbinate. We find further that after the quaintly described male flowers have disappeared, "le bouton alors est jaune; et en le coupant transversalement on *apperçoit une grande quantité de loges, dans chacune desquelles est une graine fort petite.*" This would indicate that the same receptacle bears several female flowers and not one as in *Brosimum*.

PIRATINERA A DISTINCT GENUS.

That Aublet's description was exact both as to the shape of the receptacle and the plurality of the female flowers is shown by the fact that no less than four other species with the same characters

¹ Bol. Mus. Goeldi 6: 168. 1909.

have been since reported, beginning with *Brosimum aubletii* Poepp. & Endl. and ending with *Piratinera panamensis*, which is described below.

Reservations have to be made, however, with reference to the first of these two species. In fact, it is probable that it belongs neither to *Brosimum* nor to *Piratinera*, but perhaps to *Helicostylis*, since the female flowers are described as being "solitary in the axils of the leaves," while the male flowers, which in the case of a *Brosimum* or a *Piratinera* would appear on the same receptacle, are said not to be known. The further description of the female flowers, as bearing two distinct uniovulate ovaries, and the assertion that the fruits are succulent, 2-seeded, and fleshy, far from solving the puzzle in one direction or the other, only make it more intricate. In such cases it would seem that the wisest thing to do is to lay aside the description and discount the species until more complete information has been secured.

In 1891 Taubert described his *Brosimum rubescens*, from Brazil. The female flowers are said to be 2, laterally immersed, on each receptacle, the receptacle subglobose, the filaments very short; but we are left in doubt as to the presence or absence of a perianth in the male flowers.¹ *Brosimum acutifolium* Huber,² a shrub from the Amazon basin, is also incompletely described, but we are told that there are 2 or 3 female flowers on each receptacle, which is sufficient to show that the plant is not really a *Brosimum*.

In 1911 I discovered in the rain forest near Puerto Obaldía (San Blas Coast, Panama) a large tree which was taken at first for a *Brosimum*. A large number of dried specimens were made and one inflorescence placed in alcohol. On examining this material later two female flowers, manifested exteriorly by the bifid stigmas, were found on the specially preserved receptacle, while the softened dried material showed sometimes one, very often two, and in a few cases three ovaries, each containing one ovule. Each stamen is surrounded by a distinct yellow, cuff-shaped perianth, split on one side; the receptacle is relatively large, turbinate at the base, with a flat or convex flower-bearing surface.

From the above it follows that, in opposition to *Brosimum* as defined by Swartz, we have another group of trees, in which the male flowers, also 1-staminate but less numerous, have (in one case at least) a distinct perianth, and the female flowers are 2 or more on each receptacle, this being turbinate at the base or subglobose. This I consider to be Aublet's genus *Piratinera*, which can in no way be identified with *Brosimum*.

¹ Bot. Jahrb. Engler 12: Beibl. 27: 4. 1891.

² Bol. Mus. Goeldi 6: 66. 1910.

THE ARTOCARPOIDEAE-BROSIMEAE OF TROPICAL AMERICA.

The tribe Artocarpoideae-Brosimeae is consequently represented in tropical America by 3 well-established genera, viz, *Brosimum* Swartz (type *B. alicastrum* Swartz); *Piratinera* Aubl. (type *P. guianensis* Aubl.); and *Lanessania* Baill. (type *L. turbinata* (Spruce) Baill.). In the last genus the receptacle has more or less the shape of an inverted bell, flat at the apex and bearing in the center a single female flower, this surrounded with numerous male flowers, which are 2 or 3-staminate; on the outside the receptacle is distinctly covered with small involucral bracts. *Trymatococcus* Poepp. & Endl. (type *T. amazonicus* Poepp. & Endl.) with a globose, ebracteate receptacle, bearing at the apex one female flower and many 3-staminate male flowers, should also be placed in this division of the Moraceae, rather than with the herbaceous Moraceae-Dorstenieae. In the latter the stamens are supposed to be inflexed in prefloration, while they are always erect in the Artocarpoideae-Brosimeae, a detail which has not, as far as I know, been determined with reference to the above genus.

CHARACTERS OF THE GROUP AND KEY TO THE GENERA.

Receptacle globose, subglobose, or turbinate, with numerous male flowers and 1, 2, or several female flowers.

Female flowers 2 or more. Receptacle turbinate; male flow-

ers 1-staminate, with a monophyllous perianth----- 1. *PIRATINERA*.

Female flower single.

Stamen 1 in each male flower. Receptacle globose, entirely covered with flowers and orbicular scales; male flowers without a perianth----- 2. *BROSIMUM*.

Stamens 2 or 3 in each male flower, this provided with a perianth.

Receptacle globose, ebracteate, with flowers on the flat apex only; stamens always 3----- 3. *TRYMATOCOCCUS*.

Receptacle turbinate, bracteate on the outside; stamens 2 or 3----- 4. *LANESSANIA*.

CHARACTERS OF *PIRATINERA* AND LIST OF SPECIES.

Piratinera Aubl. Pl. Guian. 2: 888. pl. 340. 1775.

Perianth of the male flowers short, tubular, split laterally; stamen 1, the anther 2-celled. Female flowers 2 or more, without a perianth, the ovary sunk into the receptacle, with short style and divaricate stigmas. Fruit globose, 2 or several-seeded.

Laticiferous trees or shrubs; leaves coriaceous, small, short-petiolate, entire; stipules small, lanceolate, caducous; receptacles pedunculate, usually solitary in the axils of the leaves, turbinate with a convex or plane surface or semi-globose; flowers intermixed with numerous orbicular, peltate bractlets.

Type species, *Piratinera guianensis* Aubl.

Known species 5, as follows:

Piratinera guianensis Aubl. Pl. Guian. 2: 888. *pl.* 340. 1775. French Guiana.

Piratinera discolor (Schott) Pittier.

Brosimum discolor Schott in Mart. Fl. Bras. 4¹: 110. *pl.* 33. 1853, excl. syn. Eastern Brazil.

Piratinera rubescens (Taub.) Pittier.

Brosimum rubescens Taub. Bot. Jahrb. Engler 12: Beibl. 27: 9. 1891. Brazil.

Piratinera acutifolia (Huber) Pittier.

Brosimum acutifolium Huber, Bol. Mus. Goeldi 6: 66. 1910. Amazonia.

Piratinera panamensis Pittier (below). Panama.

A NEW SPECIES OF PIRATINERA.

Piratinera panamensis Pittier, sp. nov.

PLATE 7.

A middle-sized or large tree, up to 25 meters high and 60 cm. in trunk diameter. Bark grayish, smooth, laticiferous. Crown irregular, depressed.

Leaves distichous, chartaceous, rather small, petiolate; petioles 5 to 7 mm. long, slender, canaliculate, minutely puberulous; blades ovate-oblong, inequilateral, rounded or subacute at the base, abruptly and shortly obtuse-acuminate at the apex, 4 to 10 cm. long, 2.5 to 3.5 cm. broad, glabrous above, the venation prominulous, beneath minutely puberulous and paler, the venation more prominent; primary veins 9 to 14; margin entire, slightly revolute. Stipules 3 mm. long, lanceolate, pubescent, caducous.

Receptacles solitary in the axils of the leaves, pedunculate, irregularly obconical with a broad, flat or slightly convex apex 1 to 1.5 cm. in diameter, the whole surface more or less covered with orbicular peltate bracts, brownish and minutely grayish-puberulous; peduncles slender, 10 to 15 mm. long, minutely puberulous, as also the free spaces on the receptacles. Male flowers yellow, bractless, scattered over the empty spaces on the surface of the receptacle; perianth tubular, 0.2 to 0.4 mm. high, funnelform, monophyllous but open on one side, minutely puberulous; stamen 0.6 to 0.7 mm. long, exserted; filament thick, erect; anther 2-celled. Female flowers 2 or more to each receptacle, without a perianth; style slender, with only the 2 divaricate stigmas showing above the surface of the receptacle.

Fruit (immature) globose-subpyriform, 1 or 2-seeded.

Type in the U. S. National Herbarium, no. 679477, collected on hills back of Puerto Obaldia, San Blas Coast, Panama, in flower, September 2, 1911, by H. Pittier (no. 4336).

EXPLANATION OF PLATE 7.—Type specimen of *Piratinera panamensis* Pittier. Natural size.

CHARACTERS OF BROSIMUM AND LIST OF SPECIES.

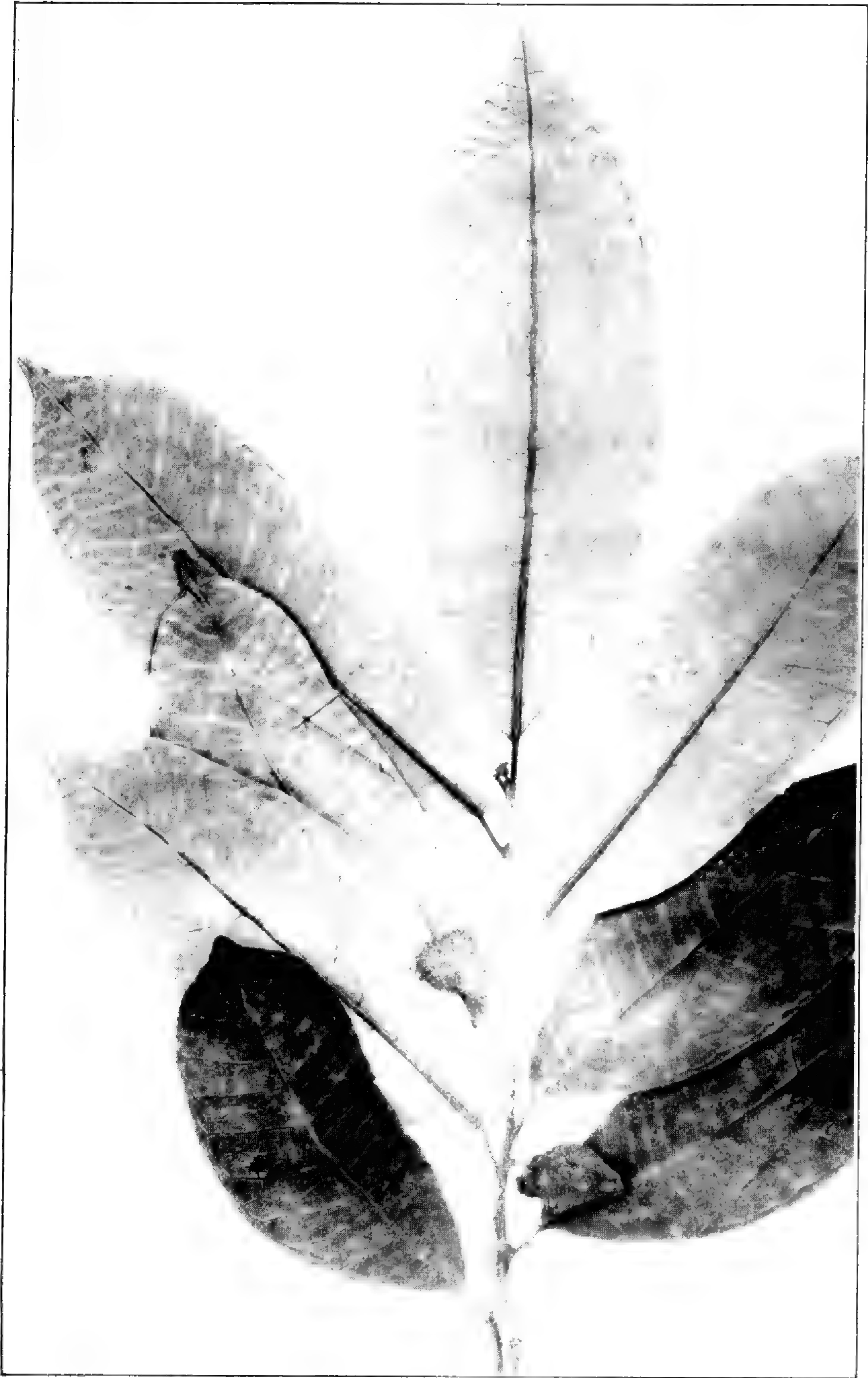
Brosimum Swartz, Prodr. Veg. Ind. Occ. 12. 1788.

Flowers without a perianth. Stamen 1, the anther 1 or 2-celled. Female flowers 1 on each receptacle, without a perianth, the ovary sunk into the receptacle, with a long style and long, divaricate or erect stigmas.

Fruit globose, 1-seeded.

Laticiferous trees; leaves membranous or coriaceous, of variable size, entire; stipules lanceolate, caducous; receptacles pedunculate, solitary or geminate in the axils of the upper leaves, globose; flowers intermixed with numerous peltate bractlets.

Type species, *Brosimum alicastrum* Swartz.



PIRATINERA PANAMENSIS PITTIER.

The following 9 species may be considered as definitely included in the genus:

Brosimum alicastrum Swartz, Prodr. Veg. Ind. Occ. 12. 1788. West Indies and Mexico.

Brosimum costaricanum Liebm. Dansk. Vid. Selsk. Afh. V. 2: 334. 1851. Costa Rica.

Brosimum utile (H. B. K.) Pittier (below). Northern South America and Central America, from Venezuela to Nicaragua.

Brosimum gaudichaudii Trécul, Ann. Sci. Nat. III. Bot. 8: 140. pl. 6. f. 172-176. 1846. Western Brazil.

Brosimum glaucum Taub. Bot. Jahrb. Engler 12: Beibl. 27: 4. 1891. Brazil.

Brosimum glaziovii Taub. op. cit. 12: Beibl. 27: 3. 1891. Brazil.

Brosimum guianense Huber, Bol. Mus. Goeldi 6: 168. 1908, excl. syn. Amazonia.

Brosimum pusillum Hassler, Bull. Herb. Boiss. II. 7: 362. 1907. Paraguay.

Brosimum terrabanum Pittier, Contr. U. S. Nat. Herb. 18: 70. 1914. Costa Rica.

All these species, according to their respective descriptions, possess the fundamental characters of the genus as originally established. With reference to the type, *B. alicastrum*, Swartz says¹ that the female flowers grow on distinct trees, in other words, that the species is dioecious. This affirmation evidently rests on a faulty examination, the style and stigmas emerging from the scaly floral involucre sometimes before the anthers. This is illustrated in the plate by Trécul,² where receptacles at various stages of development are shown on the same branchlet.

While the structure of the female flower is uniform all through the series, there is a fundamental difference in the structure of the stamen. In the type species, *B. alicastrum* Swartz, and in *B. terrabanum* Pittier, the anther consists of a single cell, in the shape of an orbicular cushion, placed horizontally at the apex of the filament; the dehiscence takes place around the outer edge, half the cell wall turning up as an inverted umbrella, the other half reflexed in the opposite direction. In the other known species the anthers are 2-celled, the cells being placed on both sides of the connective and splitting longitudinally. Thus the genus is naturally divided into two sections, *Monotheca* and *Ditheca*, which differ also as to their geographical distribution, since the species of the first type are found only in the West Indies and Middle America, while those of section *Ditheca* extend from Costa Rica southward.

The cow tree or milk tree, long known as *Brosimum galactodendron* Don, will be fully treated below.

The late Dr. Huber named his tree *Brosimum guianense* on the supposition that it was identical with *Piratinera guianensis* Aubl. and that *Brosimum aubletii* Poepp. & Endl., supposedly another name for the latter species, was not in accord with the nomenclatorial rules.³ We have already seen that the identity of *B. aubletii* is very much in doubt. Concerning *B. guianense*, Dr. Huber wrote me a short time before his premature end that "Le réceptacle est un peu plus grand qu'un grain de plomb no. 8. Fleur femelle unique. Baie mure écailleuse, un peu plus grande qu'un petit pois." Further, Dr. Huber sent at my request two specimens of this species, which are now deposited in the U. S. National Herbarium. They were collected by A. Ducke near Obidos, Amazonia (no. 9189) and in the alluvial forests of Rio Mapuera, Amazonia (no. 9072). While both answer the general description of *Brosimum*, the styles are not seen

¹ Fl. Ind. Occ. 1: 18. 1797.

² Ann. Sci. Nat. III. Bot. 8: pl. 8. 1847.

³ Bol. Mus. Goeldi 6: 168. 1909.

on the small, freely staminate receptacle, and the material is too scanty to permit the dissection necessary to find the ovary. The above statement of Dr. Huber, however, is sufficient, and I do not hesitate to maintain this species as a true *Brosimum*, generically distinct from both *Brosimum aubletii* and *Piratinera guianensis*. Its relationship to the other recently described species of *Brosimum* remains to be established.

REDESCRIPTION OF *BROSIMUM UTILE*.

The description following, which is to my knowledge the first to include all parts, shows conclusively that the milk tree is really a *Brosimum*, differing from the general type only in the hard, woody mesocarp of its fruits.

Brosimum utile (H. B. K.) Pittier.

Galactodendrum utile H. B. K. Nov. Gen. & Sp. 7: 163. 1825.

Brosimum galactodendron D. Don in Sweet, Hort. Brit. ed. 2. 462. 1830.

A laticiferous tree, 20 to 25 meters high, the trunk 40 to 50 cm. in diameter at the base. Bark thick, grayish, smooth or verrucose. Trunk erect, simple, the crown elongate; young branchlets subangular, more or less pubescent.

Leaves large, coriaceous, petiolate; petioles 0.5 to 1.5 cm. long, thick, narrowly canaliculate, sparsely pubescent; blades ovate, elliptic, rounded at the base, abruptly acuminate at the apex in a drip tip, 10 to 25 cm. long, 3.5 to 9.5 cm. broad, glabrous on both sides, green above, golden brown beneath; margin entire; venation impressed on the upper face, prominent and slightly pubescent on the lower face; primary veins 27 to 30, parallel, straight, almost transverse, forming with the costa an angle of about 70 degrees. Stipules acute-lanceolate, about 2 cm. long, silky-pubescent, caducous, leaving at each node a circular scar.

Receptacles globose, each with one female flower, solitary in the axils of the leaves, long-pedunculate, about 7 mm. in diameter in the floriferous stage. Bractlets orbicular, thick, pilose-pubescent, sessile. Staminal bractlets broad and short (0.5 mm. long), ciliate. Stamen 0.7 to 1.4 mm. long; filament smooth; anther ovate, 2-celled. Ovary inserted 2.5 to 3 mm. deep in the receptacle; emerged part of the style about 2 mm. long, woolly-pubescent, forking at about the middle into 2 slender stigmatic branches.

Fruit depressed-globose, 2 to 2.5 cm. in diameter, the epicarp fleshy, 4 to 6 mm. thick, yellow at maturity, the mesocarp (putamen) woody, rugose on the surface, entirely filled with a single almond-like, white seed.

Collected anew on hills about Puerto Obaldía, San Blas Coast, Panama, in flower and fruit, September 1 to 4, 1911, *Pittier* 4345, 4418.

Notwithstanding the incompleteness of the specimens collected by Humboldt and Bonpland, Kunth described the new genus *Galactodendrum*, the species being *G. utile*, as cited above. Later Don sagaciously perceived the close kinship with *Brosimum* and transferred the species to it under the name *B. galactodendron*, which has been maintained ever since.

In 1840 W. J. Hooker gave an emended description of the tree, founded on material about as poor as that collected by Humboldt and Bonpland, accompanied by two plates, one giving the general habit, and the other the leaf, limb, and fruit of the tree.¹ In this article the original name, *Galactodendrum utile*, was retained, the association with *Brosimum* being considered as doubtful.

¹ Curtis's Bot. Mag. 66: pl. 3723-24. 1840.

This remarkable tree was first brought to the attention of botanists by Humboldt, who describes it in the following manner:

For many weeks, we have heard a great deal of a tree whose juice is a nourishing milk. The tree itself is called the *Cow Tree*, and we were assured that the negroes on the farm, who are in the habit of drinking large quantities of this vegetable milk, consider it as highly nutritive; an assertion which startled us the more, as almost all lactescent vegetable fluids are acrid, bitter, and more or less poisonous. Experience, however, proved to us during our residence at Bárbula, that the virtues of the *Cow Tree*, or *Palo de Vaca*, have not been exaggerated. This fine tree bears the general aspect of the *Star-Apple Tree* (*Chrysophyllum cainito*); its oblong, pointed, coriaceous, and alternate leaves are about ten inches long, and marked with lateral nerves, which are parallel, and project beneath. The flower we had no opportunity of seeing; the fruit is somewhat fleshy, and contains one or two kernels. Incisions, made in the trunk of the tree, are followed by a profuse flow of gluey and thickish milk, destitute of acidity, and exhaling a very agreeable balsamic odour. It was offered to us in calabashes, and though we drank large quantities of it, both at night before going to bed and again early in the morning, we experienced no uncomfortable effects. The viscosity of this milk alone renders it rather unpleasant to those who are unaccustomed to it. The negroes and free people who work in the plantations use it, by soaking in it bread made from *Maize*, *Manioc*, *Aropa*, and *Cassava*; and the superintendent of the farm assured us that the slaves become visibly fatter during the season when the *Palo de Vaca* yields most milk. When exposed to the air, this fluid displays on its surface, probably by the absorption of the atmospheric oxygen, membranes of a highly animal nature, yellowish and thready, like those of cheese; which, when separated from the more watery liquid, are nearly as elastic as those of caoutchouc, but in process of time exhibit the same tendency to putrefaction as gelatine. The people give the name of cheese to the curd which thus separates when brought into contact with the air, and say that a space of five or six days suffices to turn it sour, as I found to be the case in some small quantities that I brought to Valencia. The milk itself, kept in a corked bottle, had deposited a small portion of coagulum, and far from becoming fetid, continued to exhale balsamic scent. When mingled with cold water, the fresh fluid coagulated with difficulty; but contact with nitric acid produced the separation of the viscous membranes.¹

Humboldt and Bonpland were inclined to think that this tree was peculiar to the coast cordillera of Venezuela, whereas subsequent information shows that its area is a very extensive one. With reference to Central America, I observed it in 1891 on the hills bordering the San Juan River on the Costa Rican side. On January 22, 1898, I camped on the ridge dividing the Savegre and Guavo rivers in Costa Rica, at the foot of a gigantic tree called "mastate" by my Brunka guides. When incised the bark yielded an abundant milk, of which I drank a whole cup without suffering any inconvenience. The bark was formerly used as a clothing material by the Indians. At the time when this tree so came under my notice botany was only of secondary interest to me, and I did not try to collect specimens or to identify the species, but there are strong reasons for believing that it was the "palo de vaca" of Humboldt, the area of which is thus extended west and northward to the border of Nicaragua. Around Puerto Obaldía it is a common element of the forest, called "palo de leche" by the natives, but it was not found in the course of my exploration in any other part of the Republic of Panama.

DOUBTFUL AND DISCARDED SPECIES OF *BROSIMUM*.

Brosimum echinocarpum Poepp. & Endl. Nov. Gen. & Sp. 2: 34. pl. 148. 1838, with the "female involucre muricate, the stigma 4-fid and feathery, and the

¹ Voy. Equin. Nouv. Cont. 2: 106 ff. 1819.

fruit echinate," certainly does not belong to the same genus, and even its place among the Moraceae is doubtful.

Brosimum spurium Swartz, Fl. Ind. Occ. 1: 20. 1797, is *Pseudolmedia spuria* Griseb.¹

Brosimum paraense Huber, Bol. Mus. Goeldi 6: 66. 1910, is probably a good species, but the description of the inflorescence is incomplete.

Brosimum speciosum Dekker, Bull. Kol. Mus. Haarlem 35: 100. 1906, is a name only.

Brosimum heteroclitum Donn. Smith, Bot. Gaz. 31: 121. 1901, is a most interesting addition to the flora of Costa Rica, but it is certainly neither a *Brosimum* nor a *Piratinera*, the ovaries being described as pluriovulate and several on each receptacle.

USES AND VERNACULAR NAMES OF SPECIES OF THE GROUP.

Brosimum alicastrum Swartz is the breadnut of Jamaica, where the seeds, roasted singly or boiled together and reduced to a paste, are used as food, having a taste not unlike that of a hazelnut. The same species is reported from Yucatán under the Maya name of "ox" (Seler) or "oox" (Schott) and the Spanish names of "ramón" and "hoja ramón." The leaves and young shoots are there considered an excellent cattle feed, but no mention is made of the fruits. In Jamaica the name "ramon," or "ramoon," is applied to *Trophis americana* L., another tree of the mulberry family from which green fodder is obtained.

According to Liebmann² and others, this species extends into Central Mexico as far as Colipa and Papantla, where cattle also feed on the leaves, the vernacular name being "ojite."

The fruits of *Brosimum costaricanum* Liebm. are used to a small extent in the same way as the breadnut in Jamaica, and the flowers, which cover the ground under the trees at the time of blooming, are said to enter into the preparation of a savory pie. Both this species and *B. terrabanum* Pittier afford fodder and are known under the common name of "ojoche." As in the Mexican "ojite," the primitive Maya root "ox" is here readily recognized, as it is also in "ojuste," the Honduran vernacular for another unidentified species. But the ending "joche" or "juche" (found besides in "cacalojoche," "esquijoche," "quisjoche," etc.)³ is derived from the Nahuatl "xochitl," flower, and hence it is also supposed that the original meaning of "ojoche" may have been *o-jochitl*, flower of the trail, on account of the deciduous receptacles covering the forest paths at a certain period of the year.

To the names "cow tree" and "palo de vaca," for *Brosimum utile*, those of "árbol de leche," "palo de leche," and "avichurí," used in Colombia, may be added, the last evidently indigenous. Cortez⁴ reproduces the following analysis by Heintz, showing that the milk is not such a substantial food as had been affirmed by Humboldt:

Water	57.3
Albumin	0.4
Wax of the form $C_{34} H_{66} O_3$	31.4
Wax of the form $C_{35} H_{58} O_7$	5.8
Gum and sugar	4.7
Salts	0.4

¹ Fl. Brit. W. Ind. 152. 1859.

² Dansk. Vid. Selsk. Afh. V. 2: 334. 1851.

³ See Pittier, Pl. Usual. Costa Rica 57. 1908.

⁴ Fl. Colomb. 126. 1896.

Information is lacking as to the economic value of the wood of the several species of *Brosimum*. That of *Piratinera guianensis* is known as "letterwood," "bois de lettre de Chine," "bois de lettre moucheté," and "bois d'amourette moucheté," names which, however, may apply also to several other species of *Piratinera* and *Brosimum*. Of the wood of the tree described by him, Aublet says that it is hard and compact, the sapwood white, and the heart red with black speckles. It is a valuable commercial asset, but a critical study of the several varieties, in connection with that of the corresponding botanical specimens, has yet to be made.

Piratinera panamensis goes among the inhabitants of Puerto Obaldía under the name of "guaímaro." Its wood is also white, fine-grained, and hard.

MAGNOLIACEAE.

A NEW SPECIES OF TALAUMA FROM PANAMA.

***Talauma sambuensis* Pittier, sp. nov.**

A large tree, 30 to 40 meters high, the trunk straight, the crown elongate. Branchlets terete, rather thick, glabrous, marked with the annular scars of the stipules and the large, orbicular, white scars of the fallen leaves.

Leaves coriaceous, glabrous, crowded at the ends of the branchlets; petioles 1.5 to 4 cm. long, slightly thicker at the base, flattened above; blades ovate-elliptic, acute-cuneate at the base, subacute or sometimes shortly obtuse-acuminate at the apex, 11 to 25 cm. long, 4.5 to 11 cm. broad, minutely reticulate, concolorous, more or less lustrous on both faces; costa impressed above, very prominent beneath; primary veins alternate, prominulous on both faces, about 12 on each side of the costa, arcuate-anastomosed but first running straight to within a short distance (5 to 7 mm.) of the margin, each of them joining there with the anterior one, then turning almost abruptly to form a flat bow parallel to the margin; margin broadly sinuate. Stipules lanceolate, finely granular-reticulate, glabrous, caducous, about 2 cm. long.

Flowers not known.

Syncarp pedunculate, subglobose, about 8 cm. long and 7.5 cm. in diameter, woody, squamose-areolate, the carpel tips free, lanceolate, obtuse at the apex. Seeds not known.

Type in the U. S. National Herbarium, no. 715960, collected at Boca de Pauarandó on the Sambú River, southern Darién, Panama, fruit, February, 1912, by H. Pittier (no. 5681).

The fewness and incompleteness of the specimens in American herbaria of the several recognized species of *Talauma*, as well as the brevity of their descriptions, make it very difficult to estimate the relative value of the dominant characters and to discriminate between forms which may represent simply variations of one specific type. The above tree is evidently a near relative of *Talauma ovata* St. Hil., from Brazil, but seems to differ in the size and shape of the leaves, and in the smooth petioles and the number of primary veins. In *T. plumieri* DC., the "bois-pin" of Martinique, in *T. minor* Urban, from Jamaica, and in *T. gloriensis* Pittier, from Costa Rica, the netting of the veinlets is coarser, the leaf scars are distinct in size and shape, etc. Other differences appear when we compare our specimens with the other American species of the genus, for which reason it is considered preferable for the present to describe the Panama species as a distinct type.

GROSSULARIACEAE.

A NEW SPECIES OF RIBES FROM THE VENEZUELAN ANDES.

Ribes canescens Pittier, sp. nov.

A shrub with erect stems, the young shoots more or less cano-pubescent.

Leaves with petioles 1.5 to 2 cm. long, these white-tomentose; blades emarginate at the base, distinctly 3-lobate, about 3.5 cm. long and 4 cm. broad, membranous, glabrous above, whitish felted tomentose beneath, irregularly toothed on the margins, the median lobe larger, the teeth glandular-mucronate.

Male racemes pendulous, 6 to 9 cm. long, the rachis slender, more or less tomentose, and covered with pedicellate glands. Bracts lanceolate, cano-pubescent, glandular on the margins, 6 to 7 mm. long; bractlets lanceolate, clasping at the base, pubescent, 3 to 3.5 mm. long. Flowers about 8 mm. long, reddish, the pedicels about 2 mm. long. Receptacle tomentellous, eglandular. Sepals lance-acuminate, about 3 mm. long, 1.5 mm. broad, dark-veined, minutely tomentose without, flat, erect. Petals obovate-spatulate, flat, glabrous, about 2.5 mm. long, 1.2 mm. broad. Stamens slightly shorter than the petals, apparently erect, glabrous, the anthers yellow, ovoid. Ovary rudimentary, glabrous, conical; style bilobate. Female inflorescence not seen.

Fruit not known.

Type in the U. S. National Herbarium, no. 703585, collected on the Páramo de Piedras Blancas, Andes of Mérida, Venezuela, male flowers only, March 27, 1915, by Dr. A. Jahn (no. 414).

Janczewski¹ cites from the same region a variety of *Ribes andicola*, with the leaves whitish-tomentose beneath. This can not be the above species, which belongs to the section with flat petals and differs besides in the absence of feathery bristles at the base of the leaves and in these being eglandular or nearly so and the sepals not ligulate.

ROSACEAE.

OLD AND NEW SPECIES OF OSTEOMELES.

Osteomeles cuneata (Lindl.) Decaisne, Nouv. Arch. Mus. Hist. Nat. Paris 10: 184. 1874

FIGURE 44.

Hesperomeles cuneata Lindl. Bot. Reg. 23: under pl. 1956. 1837.



FIG. 44.—Leaf of *Osteomeles cuneata*. Natural size. From U. S. Exploring Expedition, no number, in U. S. National Herbarium.

A low, procumbent, spinescent shrub, the younger branchlets minutely pilosulous.

Leaves with petioles hardly over 1 mm. long; blades oblong-spatulate, long-cuneate at the base, rounded at the apex, often subtrilobate, 5 to 20 mm. long, 4 to 7 mm. broad, pilosulous or glabrescent on both faces, lustrous, the veins brownish, immersed, and inconspicuous above, pale brownish green and brownish-reticulate beneath, the costa prominent at the base, the angle of the main veins very acute (about 15 degrees); margin serrulate on the upper half of the blade, the teeth each bearing a caducous gland.

Corymbs equal to or shorter than the branchlets. Bracts acicular or spatulate-lanceolate, very narrow, villosulous, up to 4 mm. long. Pedicels cano-pubescent, 1 to 2 mm. long. Flowers 5 mm. long. Receptacle subglobose, more or less grayish-hairy without, densely white-tomentose on

¹ Mém. Soc. Phys. Hist. Nat. Genève 35: 411. 1907.

the disk within. Calyx lobes triangular-apiculate, the broader base hairy, the tips glabrous. Petals glabrous, flat, suborbicular, 3 to 3.6 mm. long and broad, attenuate at the base into a broad claw, the margin more or less sinuate. Stamens numerous, about 2.5 mm. long, the anthers broader than long. Styles thick, clavate, cano-tomentose at the base, about 3 mm. long; stigma undivided.

Fruit not seen.

Type from Peru. The above description is from specimens in the U. S. National Herbarium, collected by the U. S. Exploring Expedition under the command of Capt. Wilkes, and others collected in Peru.

***Osteomeles incerta* Pittier, sp. nov.**

FIGURE 45.

An unarmed, erect shrub, the old bark grayish, the young branchlets ferruginous, furfuraceous.

Leaves alternate (not fasciculate); petioles 1 to 5 mm. long; blades coriaceous, rather thick, broadly ovate, subattenuate at the base, obtuse, emarginate, subacute, or apiculate at the apex, 10 to 25 mm. long, 5 to 15 mm. broad, more or less villosulous (principally on the costa), lustrous and minutely bullate-reticulate above, paler, glabrous or glabrescent, and reticulate beneath; venation impressed above, prominulous beneath; angle of the main primary veins about 60 degrees; margin sinuate-serrate, the teeth glandular. Stipules ovate-oblong, small, ferruginous-pubescent, caducous.

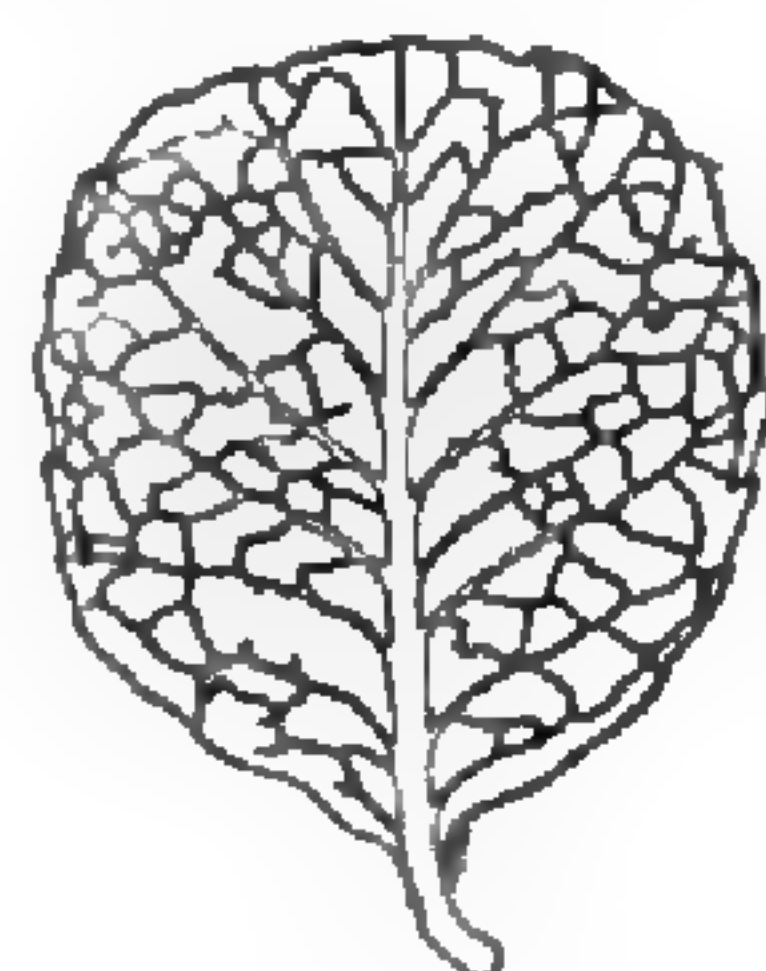


FIG. 45.—Leaf of *Osteomeles incerta*. Natural size. From type specimen.

Corymbs shorter than the leaves, 3 to 5-flowered, the rachis densely ferruginous-pubescent. Bracts lanceolate, attenuate toward the base and broadening again at the insertion, acute at the apex, villosulous, 3 to 7 mm. long or over, 0.5 to 1 mm. broad. Pedicels 3 to 5 mm. long, ferruginous-hairy. Flowers about 3 mm. long. Receptacle subglobose, more or less pilosulous; calyx lobes triangular-apiculate, more or less ferruginous-hairy almost to the apex, 4 to 4.5 mm. long. Petals broadly ovate, contracted at the base into a very short claw, obtuse at the apex, 5 mm. long, 3.5 to 4 mm. broad. Stamens glabrous, about 4.5 mm. long, the anthers ovate, about as broad as long. Disk brown-woolly. Styles slender, woolly at the base, 4 to 4.5 mm. long; stigmas discoid, undivided.

Fruit not known.

Type in the U. S. National Herbarium, no. 325749, collected in Bolivia, precise locality not stated, by Miguel Bang (no. 1839).

In the absence of the types or of more precise descriptions, it is extremely difficult to name with any degree of certainty any species of *Osteomeles*. The above species agrees in several particulars with the original description of *O. pernettyoides* (Wedd.) Decaisne, but differs also in about as many details. The leaves are seldom oblong-lanceolate, generally much larger than in the typical form (*O. pernettyoides microphylla*), and not glabrous or glaucous beneath as in the large-leaved form. Although reluctant to do so, I feel obliged to place this form under a separate name until a general revision of the types can be undertaken.

***Osteomeles intermedia* Pittier, sp. nov.**

FIGURE 46.

An erect, unarmed shrub, the old bark gray, glabrous, sparsely verruculose, the young branchlets grayish-pubescent and verruculose-tuberculate.

Leaves alternate; petioles canaliculate, 4 to 5 mm. long, sparsely grayish-pubescent; blades membranous, ovate, oblong, or obovate, rounded or cuneate at the base, acute at the apex, 1.5 to 3.5 cm. long, 1 to 1.7 cm. broad, lustrous,

minutely impressed-reticulate and glabrescent or sparsely grayish-pubescent above (the pubescence much denser on the costa), pale, prominulous-reticulate, and sparsely pilosulous beneath, glandular-serrulate except at the base. Stipules acute, grayish-pubescent, 1 to 5 mm. long, subpersistent, numerous at the base of the branchlets.



FIG. 46.—Leaf of *Osteomeles intermedia*. Natural size. From type specimen.

Corymbs much shorter than the leaves, 3 to 7-flowered, the rachis and pedicels sparsely grayish-pubescent. Bracts linear-acuminate, canaliculate, biappendiculate at the base, very sparsely pilosulous, 4 to 6 mm. long. Pedicels hardly over 1 mm. long. Flowers about 7.5 mm. long. Receptacle broadly obconical, sparsely grayish-pubescent. Calyx segments triangular-apiculate, broad and sparsely tomentose at the base, glabrous and glandular at the apex, about 3 mm. long. Petals white, ovate-oblong, concave, sessile, more or less distinctly apiculate, sinuate on the margin, 4 to 4.5 mm. long, 2.5 to 3 mm. broad. Stamens glabrous, the anthers about as broad as long. Disk densely white-tomentose. Styles rather thick, glabrous (except at the base); stigma discoid.

Fruit not known.

Type in the U. S. National Herbarium, no. 533720, collected in the Cordillera de Santa Marta, Colombia, at an altitude of about 2,750 meters, January, 1898–1901, in flower, by H. H. Smith (no. 1751).

Distributed under the name of *Osteomeles oblongifolia* Lindl., which, however, did not exist previously. Intermediate between the large-leaved and small-leaved species.

***Osteomeles obovata* Pittier, sp. nov.**

FIGURE 47.

A low, spinescent, erect shrub, the young branchlets glandular and ferruginous-hairy.

Leaves with petioles 2.5 to 5 mm. long; blades obovate or oblong-spatulate, cuneate at the base, truncate, rounded, obtuse, or subacute at the apex, 13 to 28 mm. long, 5 to 10 mm. broad, glabrous, or sparsely hairy on the costa, and lustrous above, dull, glabrous, and reticulate beneath; venation brown; angle of the primary veins about 33 degrees; margin sinuate-serrate, the teeth glandular. Stipules hardly more than 2 mm. long, narrow, acute, setaceous, deciduous.

Corymbs few-flowered (sometimes reduced to one flower), much shorter than the leaves, the rachis glandular and densely ferruginous-hairy. Bracts narrowly lanceolate, glabrous, 5 mm. long or less. Pedicels 1 to 2 mm. long, ferruginous-hairy. Flowers about 5 mm. long. Receptacle ovoid or subglobose, sparsely villous. Calyx lobes acicular, distant, hardly broadened at the base, more or less hairy on the lower half, 2 to 2.2 mm. long. Petals flat, broadly ovate or suborbicular, 2.8 to 3.5 mm. long, 2 to 2.4 mm. broad, contracted at the base into a short claw. Stamens glabrous, about 2.4 mm. long, the anthers ovoid, slightly longer than broad. Disk cano-tomentose. Styles terete, glabrous, 2.5 to 3.2 mm. long; stigma bilobulate.

Fruit not known.

Type in the U. S. National Herbarium, no. 700625, collected on Irazú Volcano, Costa Rica, at an altitude of about 3,000 meters, in flower, June 25, 1874, by Otto Kuntze.

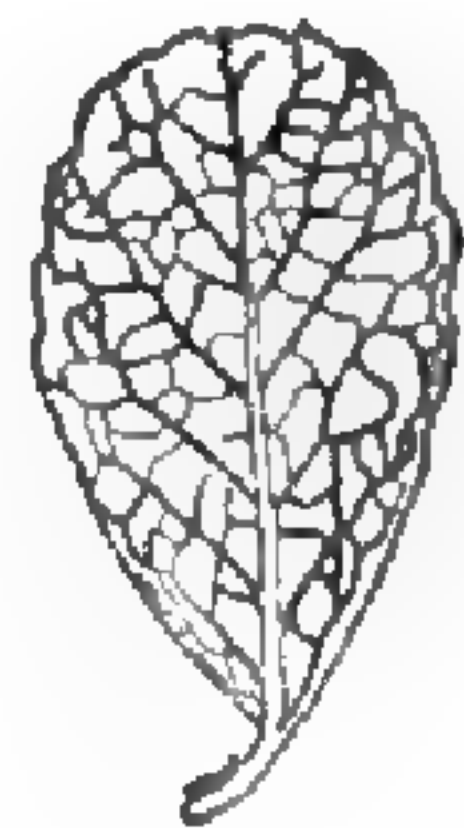


FIG. 47.—Leaf of *Osteomeles obovata*. Natural size. From type specimen.

There are the following additional specimens:

COSTA RICA: Irazú Volcano, flowers, March, 1894, *J. D. Smith* 4772. Potrero del Alto, Poás Volcano, January, 1888, *Pittier* (Inst. Fís. Geogr. Costa Rica, no. 326).

Otto Kuntze identified his specimens as *Osteomeles heterophylla* Ruiz & Pav., a species figured in the yet unpublished volume 4 of the *Flora Peruviana*.¹ This I have not seen, but considering the fact that the known small-leaved species of *Osteomeles* all have rather reduced areas of dispersion, I feel doubtful about this determination. On the other hand, Captain John Donnell Smith considered the specimens collected by himself and the writer to be *Osteomeles pernettyoides* (Wedd.) Decaisne, which is perhaps nearer the truth, since this species is known to reach the northernmost end of the Central Cordillera of Colombia, in the Páramo de Tolima, separated from the high Costa Rican mountains only by the Isthmian gap. But in our specimens the leaves are mostly obovate or oblong and seldom if ever lanceolate, the corymbs are few-flowered, with the rachis densely glandular-hairy and not simply villosulous, and the calyx segments, standing far apart, could hardly be called triangular-subulate.

***Osteomeles pachyphylla* Pittier, sp. nov.**

FIGURE 48.

A low, procumbent, spinescent shrub, the young branchlets ferruginous scaly pubescent and glandular.

Leaves alternate or subopposite; petioles 1 to 3.5 mm. long; blades coriaceous, thick, suborbicular to ovate, rounded-attenuate or subemarginate at the base, acute at the apex, 10 to 24 mm. long, 5 to 18 mm. broad, glabrous (or minutely pubescent above on the costa), reticulate and lustrous above, paler and beautifully reticulate beneath; venation impressed above, prominent and of a darker color beneath; angle of the main veins about 56 degrees; margin sinuate-toothed, thickened all around the blade, the teeth glandular. Stipules lanceolate, concave, scarious, brownish, puberulous, caducous or subpersistent, 2 to 5 mm. long.



FIG. 48.—Leaf of *Osteomeles pachyphylla*. Natural size. From type specimen.

Corymbs shorter than the leaves, subsessile. Bracts apiculate, broadened at the base, glandular at the tip, more or less setulose-hairy on the lower half, 3 to 5.5 mm. long. Pedicels more or less ferruginous-hairy, 2 to 3 mm. long. Flowers about 8.5 mm. long. Receptacle ovoid, glabrous or sparsely pilosulous. Calyx lobes triangular-acuminate, 1.2 to 2.8 mm. long, glabrous or sparsely villosulous. Petals orbicular, concave, pinkish white, 3.5 to 3.8 mm. long, 3.2 to 3.6 mm. broad. Stamens connate at the base, 4 to 5 mm. long, the filaments slender, the anthers purplish, ovoid, longer than broad. Disk ferruginous-villosulous. Ovules 5, anatropous; styles terete, slender, about 5 mm. long, woolly at the base; stigmas bilobulate.

Fruit not seen.

Type in the U. S. National Herbarium, no. 531379, collected on rocky ledges of the Páramo de Buena Vista, Huila Group, Central Cordillera of Colombia, at an altitude of about 3,600 meters, in flower, January 25, 1906, by H. Pittier (no. 1183).

Closely related to *Osteomeles pernettyoides glauca* Decaisne, but differing in the glandular, scaly, ferruginous pubescence, the thick, coriaceous leaves, etc.

In prefloration, the filaments are inflexed-geniculate and the anthers crowded, apex downward, around the styles.

¹ Pl. 425. f. 2.

Osteomeles pernettyoides (Wedd.) Decaisne, Nouv. Arch. Mus. Hist. Nat. (Paris) 10: 184. 1874. FIGURE 49.

Hesperomeles pernettyoides Wedd. Chlor. And. 2: 230. 1861.

A spinescent, erect shrub, 2 to 3 meters high, the old bark a rather dark gray, the young branchlets more or less brownish-puberulous and verruculose.

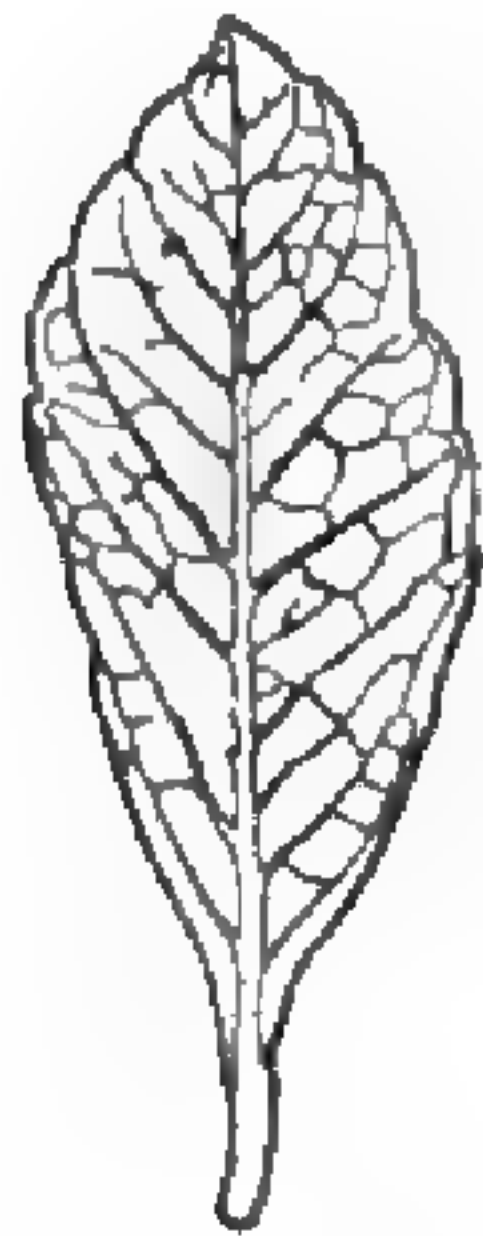


FIG. 49.—Leaf of *Osteomeles pernettyoides*. Natural size. From *Cook and Gilbert* 1873.

Leaves subopposite or alternate; blades coriaceous, ovate, obovate, or lanceolate, cuneate at the base, more or less decurrent on the petiole, rounded-obtuse or acute at the apex, 1 to 3 cm. long, 0.5 to 1.2 cm. broad, entirely glabrous, lustrous above, pale, dull, and prominulous-reticulate beneath, glandular-serrulate; angle of the primary veins about 61 degrees. Stipules small, acute.

Corymbs few-flowered, shorter than the leaves.

Fruits oblong, about 5 mm. long, crowned with the persistent calyx segments.

Type from the vicinity of the Volcano of Sorata, Province of Larecaja, Peruvian Andes, flowers and fruit, March, 1859, *Mandon* 653.

The above description is drawn from specimens collected at Piñasnlocj, Panticalla Pass, Peru, at an altitude of about 3,600 meters, in fruit, July 16, 1915, *Cook & Gilbert* 1873.

This species has been reported further from the following localities:

COLOMBIA: Laguna Verde, Andes de Tuquerres, alt. 3,200 meters, *Triana*. Quindíú, Central Cordillera, alt. 3,000 meters, *Triana*. Páramo de Colima, Central Cordillera, *Linden* 945.

PERU: Between Cajamarca and Chachapoyas, alt. 3,500 meters, *Raimondi*. Cordilleras de Cuzco, *Gay*.

BOLIVIA: Cordillera de Sorata, Department of La Paz, *Mandon*. Unduavi, alt. 3,300 meters, in fruit, October, 1885, *Rusby* 2039.

Osteomeles resinoso-punctata Pittier, sp. nov. FIGURE 50.

A low, spinescent shrub, the branchlets twisted and knotty, the old bark gray, the young branchlets sparsely grayish-pubescent.

Leaves alternate or fasciculate at the nodes; petioles about 4 mm. long; blades subcoriaceous, ovate or ovate-lanceolate, cuneate at the base, mostly acute at the apex, 15 to 25 mm. long, 4 to 11 mm. broad, lustrous, pilosulous (principally on the costa), and prominulous-reticulate above, paler, reticulate, and sparsely pilosulous or glabrescent beneath; angle of the primary veins about 43 degrees; margin serrate-glandular on the upper two-thirds of the blade, with a transparent, resinous-looking spot corresponding to each tooth. Stipules acute-triangular, mucronate, sparsely hairy, 1 to 2 mm. long, caducous.

Corymbs axillary or terminal, longer than the leaves, 3 to 6-flowered, the rachis thick, sparsely hairy. Bracts linear-subulate, canaliculate, broadened and clasping at the base, glabrous, 4 to 6 mm. long. Pedicels 2 to 4 mm. long, more or less hairy. Flowers 9 to 10 mm. long. Receptacle broadly obconical, more or less grayish-pubescent, the disk sparsely pilosulous. Calyx segments triangular-acute, glabrous, about 3.5 mm. long. Petals white, concave, ovate or obovate, broadly cuneate at the base, rounded-obtuse at the apex, about 6 mm. long, 3.5 to 4 mm. broad. Stamens glabrous, about 4.5 mm. long, the anthers about as broad as long. Styles slender, nearly 5 mm. long, slightly woolly at the base; stigmas discoid, undivided.

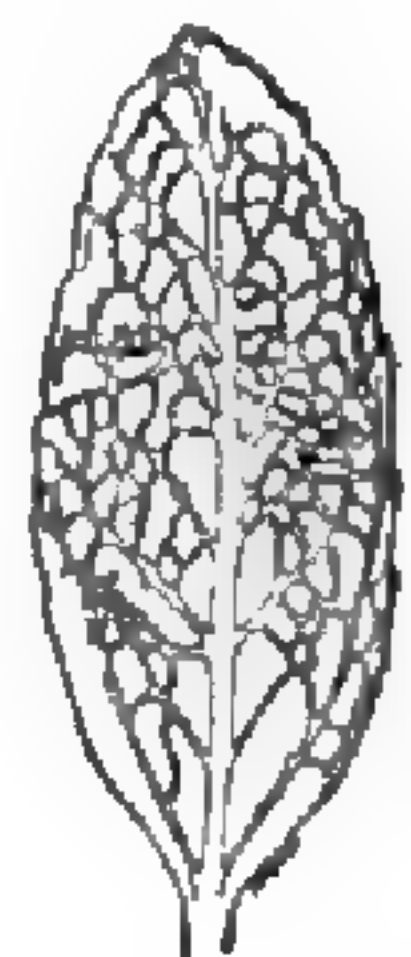


FIG. 50.—Leaf of *Osteomeles resinoso-punctata*. Natural size. From type specimen.

Fruit not known.

Type in the U. S. National Herbarium, no. 703583, collected on the Páramo de Piedras Blancas, State of Mérida, in the Venezuelan Andes, at an altitude of about 3,800 meters, in flower, March 27, 1915, by Dr. A. Jahn (no. 412).

This species has the largest flowers among the high Andine species of *Osteomeles*. It is otherwise readily distinguished from the other small-leaved species by the transparent spot accompanying the teeth and the linear, canaliculate bracts.

CAESALPINIACEAE.

A NEW COLOMBIAN SPECIES OF *BROWNEA*.

Brownea bolivarensis Pittier, sp. nov.

A shrub or a small tree, up to about 5 meters high, the trunk 10 cm. in diameter at the base, the branchlets glabrous, with slightly scaly, verruculose bark.

Leaves mostly 3-jugate; rachis 7 to 16 cm. long, terete, narrowly canaliculate, lenticellate or verruculose, the petiolar part 1 cm. long or less. Leaflets opposite, glabrous, glandular at the base; petiolules blackish, stout, rugose-plicate, glabrous, 3 to 4 mm. long; blades elliptic or elliptic-oblong, attenuate and rounded or subcordate at the base, acutely long-acuminate at the apex, subinequilateral with the broader half on the lower (outer) side, the basal 3 to 15 cm. long, 1.5 to 4 cm. broad, the terminal 18 to 25 cm. long, 5 to 7 cm. broad; upper face of leaflets smooth, pale green, with prominent costa and veins; lower face finely reticulate, the costa and veins prominent, the latter doubly anastomosed along the margin; glands basal on either side of the costa. Stipules caducous, not seen.

Spikes pendulous, 7 to 15-flowered, up to 15 cm. long, growing from older branchlets. Rachis ferruginous-pubescent. Bracts caducous, not seen. Pedicels ferruginous-pubescent, 1 cm. long. Sheath tubular-campanulate, 2.2 cm. long, minutely ferruginous-pubescent, the lobes rounded and subacute at the apex. Receptacle tube about 1 cm. long, widening from base to apex. Sepals 4, oblong or obovate, attenuate at the base, subobtusate at the apex, minutely pubescent without, the anterior one 3 cm. long, 1.1 to 1.2 cm. broad, the others 3.3 cm. long, 0.8 cm. broad. Petals obovate-spatulate, attenuate at the base into a slender claw about 1 cm. long, rounded at the apex, 4.7 cm. long, 1.5 cm. broad, pinkish red, glabrous. Stamens 11, 4 to 4.5 cm. long, glabrous, the filaments connate into a tube 3.5 cm. long; anthers oblong, 5 mm. long, 1.5 mm. broad, hairy inside at the apex. Pistil about 6.2 cm. long (stipe 0.8 cm., ovary 1.7 cm., style 3.7 cm.); stipe and ovary ferruginous-pubescent; style glabrous.

Legume 15 to 25 cm. long, 4.5 cm. broad, 4 to 6-seeded, expelling the seeds by the curling of the valves. Seeds oblong or obovate, more or less angular, laterally compressed, 2.2 to 2.7 cm. long, 1 to 1.5 cm. broad, about 0.8 cm. thick.

Type in the U. S. National Herbarium, no. 920170, collected on the trail between Norosí and Tiquisio, Department of Bolívar, Colombia, at an altitude of 150 to 600 meters, in flower and fruit, April-May, 1916, by H. M. Curran (no. 142).

This species is intermediate between *Brownea macrophylla* Linden and *B. latifolia* Jacq. With the first it has in common the inflorescence growing from the old wood, but it differs from it in most of the other characters. It has the 3-jugate leaves of the second, but with proportionally much narrower, differently shaped leaflets and much larger flowers.

A NEW SPECIES OF BAUHINIA FROM PANAMA.

Bauhinia ligulata Pittier, sp. nov.

Section Pauletia. A large, unarmed tree, up to 40 meters high and 80 cm. in trunk diameter. Bark brownish, rimose. Trunk straight, the limbs short, forming an elongate crown. Wood very hard.

Leaves petiolate, the petioles 2 cm. long, slender, deeply sulcate; blades coriaceous, 4 to 10 cm. long, 4 to 7.5 cm. broad, ovate, slightly emarginate at the base, bicuspidate at the apex with two short, subacute tips (sinus seldom over 12 mm. deep), smooth and almost shining above, grayish and minutely pubescent beneath; veins 13, the basal pair marginal, very salient beneath. Stipules ovate-elliptic, very small, scarious, caducous.

Inflorescences terminal, or of axillary, multiflorous, spiciform racemes at the ends of the branchlets. Buds claviform, ferruginous-pubescent, 2 to 2.5 cm. long just before anthesis. Flowers pedicellate, medium-sized, the bracts very small, caducous, the pedicels 2 to 6 mm. long, ferruginous-pubescent. Receptacle obconical, short-stipitate, about 7 mm. long. Calyx lobes 5, narrow, about 14 mm. long, more or less adnate, curled and reflexed in the later stages of anthesis. Petals 5, ovate-elliptic, attenuate at the base and short-unguiculate, acute at the tip, 3 cm. long, 6 mm. broad, slightly curled and sinuate on the margin, of a beautiful lilac color with the rib and pinnate veins dark purple. Stamens 10, all fertile, 5 long and 5 short, free to the base, entirely glabrous; filaments of long stamens about 25 mm. long, incurved, thicker at base; anthers ovate-elliptic, more or less open at the base, about 5 mm. long. Pistil glabrous, adnate at the base to the tube of the receptacle, then surrounded by two spathaceous ligules, these inserted on the receptacle inside the stamens, acute at the apex, hairy on the margin, 6 to 7 mm. long; ovary stipitate, 5 or 6-ovulate; style thick, the stigma papillose, depressed in the center, somewhat 3 or 5-lobed.

Fruit not known.

Type in the U. S. National Herbarium, no. 679475, collected in the forests around Puerto Obaldia, San Blas Coast, Panama, near sea level, in flower, September 2, 1911, by H. Pittier (no. 4334).

This remarkable species is probably the largest representative of the genus. The individual felled to obtain specimens measured 31 meters from foot to top and 63 cm. in trunk diameter, and a few of the other trees around this were much larger. It belongs to the group Pauletia with ovate or broadly elliptic petals, but differs from all the other species of the section by its short bicuspidate leaves and the form and size of the petals, and by the spathaceous envelopes at the base of the pistil, a character apparently not noticed heretofore in any other species of the genus.

FABACEAE.

A NEW SPECIES OF ATELEIA FROM COLOMBIA.

Ateleia herbert-smithii Pittier, sp. nov.

FIGURE 51.

A tree, the young branchlets rather thick, knotty, lenticellate, at first minutely fulvous-pubescent, later glabrate.

Leaves 7 or 9-foliate, the rachis slender, terete, attenuate from the base, glabrous, 10 to 18 cm. long; stipules wanting or early caducous. Leaflets alternate, membranous; petiolules minutely pubescent, 4 to 8 mm. long; blades ovate, inequilateral, broad, subcordate, truncate, or abruptly acutate at the base, attenuate-acuminate and rounded-obtuse at the apex, 4 to 9.5 cm. long,

2.5 to 4.5 cm. broad, glabrous, the costa slightly prominent beneath, the veins and reticulation inconspicuous; stipels early caducous or wanting.

Inflorescence racemose-paniculate, terminal, densely flowered, about 20 cm. long, the rachis densely flowered, the individual racemes 5 to 9 cm. long. Flowers pedicellate, the pedicels 2 to 3 mm. long, pubescent, subtended at the base by a minute, pubescent bractlet. Calyx broadly campanulate, 3 mm. long, entire or slightly sinuate on the margin, minutely puberulous or pubescent, persistent. Petal 1, yellow, glabrous, the claw about 3 mm. long, narrow, the blade ovate or suborbicular, reflexed, conchoid, about 5 mm. long and broad, irregularly sinuate on the margin. Stamens 10, 5 long and 5 short alternating, the former exserted, about 4 mm. long, the shorter ones subincluded; filaments slender, free or very slightly connate at the base; anthers dorsifixed, broadly ovate, the connective much shorter than the cells.

Ovary stipitate, compressed, ovate, about 3 mm. long and 1.5 mm. broad, 2-ovulate, densely brownish-pubescent; stigma sessile, ovate-elliptic and concave, placed laterally to the apex on the ventral margin; ovules 2, amphitropous, borne on a short hilum.

Fruit not known.

Type in the U. S. National Herbarium, no. 703851, collected in Santa Marta, Colombia, 1898-9, by H. H. Smith (no. 817).

The type of the genus *Ateleia*, *A. pterocarpa* Moc. & Sessé, is Mexican. Two or three more species have been reported from Yucatán and the Greater Antilles, and more recently two new additions have been described, one from Brazil (*A. glazioviana* Baill., 1892) and another from Bolivia (*A. guaraya* Herzog, 1909). The species here described inhabits the intermediate belt of South America, and shows the area of the genus to extend uninterruptedly from Mexico to Bolivia and eastern Brazil.

Ateleia herbert-smithii differs from all the other species of the genus in the shape of the leaflets. These, further, are distinctly and regularly alternate, as in *A. pterocarpa*, in which they are smaller, ovate, and more numerous. The young pods on the type specimens are ovate and 2-seeded, with the placental suture winged.

The species is named in honor of Mr. Herbert H. Smith, whose rich and well prepared collections of the flora of Santa Marta constitute one of the best recent contributions to the study of the flora of tropical America.

A VENEZUELAN SPECIES OF APOPLANESIA.

***Aoplanesia cryptopetala* Pittier sp. nov.**

FIGURE 52.

A shrub or small tree, the young branchlets glandular and tomentellous.

Leaves 13 to 21-foliolate, the rachis terete, 12 to 17 cm. long, tomentellous and sparsely glandular. Leaflets subcoriaceous, opposite, subopposite, or alternate, the petiolules 3 to 4 mm. long, grayish-hairy, sparsely glandular, the blades ovate-oblong, rounded at the base, rounded-emarginate at the apex, 2.5 to 6 cm. long, 1.5 to 2.5 cm. broad, minutely pilosulous above, paler, reticulate, sparsely pubescent, and black-glandular beneath, the costa densely hairy and the veins more or less so. Stipules wanting.

Inflorescence terminal, the numerous erect spikes paniculate, the rachis hairy, up to 20 cm. long. Bracts wanting; bractlets very small, hairy, acute, early caducous. Perfect flowers not seen. Pedicels hairy, short. Calyx hairy, 5-toothed. Petals 5, early deciduous. Stamens 10, the vexillar one free or



FIG. 51.—Floral details of *Ateleia herbert-smithii*. a, Flower; b, ovary; c, androecium. Natural size. From type specimen.

almost so. Ovary sessile, suborbicular, depressed, hairy, 2-ovulate; style filiform, geniculate close to the apex, hairy on the lower two-thirds of its length; stigma discoid, inconspicuous.

Calyx very much enlarged after flowering, the tube about 2.5 mm. long, hairy and covered with large black glands without, the lobes membranous, ovate-elliptic or obovate, hairy without, 3-nerved, beautifully reticulate, sparsely glandular, 8 to 9.5 mm. long (the carinal one shortest), 2.5 to 3.5 mm. broad.

Type in the U. S. National Herbarium, no. 602365, collected in Quebrada del Tigre, State of Lara, Venezuela, in bud and immature fruit, September 6, 1910, by Dr. A. Jahn (no. 173).

Until recently *Apoplanesia* was known to botanists only by a single obscure species from Mexico. The discovery by Dr. Jahn of a new member of the genus



FIG. 52.—Calyx of *Apoplanesia cryptopetala*. Natural size. From type specimen.

in Venezuela is therefore highly interesting. It will be noticed, however, that the new species differs from the generic type in having a 2-ovulate ovary, which will necessitate a slight change in the characterization of the group. In all the other characters the agreement is perfect. In our specimens, the numerous spikes of the inflorescences bear at the base a considerable number of flowers past the fertilization stage and with the calyx lobes fully developed, while the upper two-thirds

of the rachis is covered with very young buds. In the more advanced among these, the 5 petals are present, though imperfectly developed, but it was not possible to find them in any of the open flowers, in which the stamens with full anthers and the ovary scarcely turning into fruit were always present.

It is also a remarkable coincidence that the Mexican and Venezuelan species should be known under the same name of "palo de arco," or bow-wood.

OLD AND NEW SPECIES OF MACHAERIUM.

Machaerium acuminatum H. B. K. Nov. Gen. & Sp. 6: 391. 1825.

A tree, the branchlets terete, striate, glabrous.

Leaves 3 or 5-foliolate, glabrous, the rachis 6 to 8 cm. long. Leaflets coriaceous, the petiolules thick, sulcate, reddish, 3 to 4 mm. long, the blades ovate to oblong, rounded at the base, long-acuminate at the apex, 4.5 to 7.5 cm. long, 2 to 3.5 cm. broad, reticulate on both sides. Stipules wanting.

Inflorescences racemose, axillary or terminal, simple or branched, the peduncles 2 to 4 cm. long, glabrous. Flowers sessile, 6.5 to 7.5 mm. long; standard fuscous-pubescent; stamens diadelphous. Other floral details not known.

Legume 7 to 9 cm. long, stipitate, the stipe ferruginous-pubescent, 7 to 8 mm. long, the seminal part at first ferruginous-pubescent, 2.5 cm. long, 1.3 cm. broad, slightly curved, the wing falcate, rounded-obtuse at the apex, 2 to 2.3 cm. broad.

Type collected by Humboldt and Bonpland between San Pedro and La Victoria, near Hacienda del Tuy, State of Aragua, Venezuela.

Collected also at Colonia Tovar, State of Aragua, in fruit, *Fendler* 1913.

Machaerium bondaense Pittier, sp. nov.

A tree about 5 meters high, the branchlets terete, glabrous, lenticellate.

Leaves 7 or 9-foliolate, the rachis glabrescent or minutely pilosulous, 5 to 9 cm. long. Leaflets coriaceous, the petiolules 3 to 4 mm. long, minutely puberulous, the blades oblong, rounded at the base, attenuate-obtuse at the apex, 2.5 to 8 cm. long, 1.8 to 3.2 cm. broad, glabrous and minutely prominulous-reticulate above, beneath paler, puberulous, the costa and veins prominent, dark-colored. Stipules caducous, not seen.

Inflorescences axillary and terminal, paniculate, the rachis minutely grayish-pubescent. Flowers sessile, the other details not known.

Legume about 4.5 cm. long, long-stipitate, the stipe pubescent, 6 to 7 mm. long, the seminal part about 1 cm. long, 0.8 cm. broad, glabrous, arcuate, the wing membranous, cultrate, obtuse, mucronulate, loosely prominulous-reticulate, 1.1 cm. broad.

Type in the herbarium of the New York Botanical Garden, collected in dry forest near Bonda, Santa Marta, Colombia, almost at sea level, in fruit, November 1, 1898, by H. H. Smith (no. 702).

Labeled as *Machaerium acuminatum* H. B. K., but hardly to be confused with that species and apparently not closely related to any known species of the section *Reticulata*, to which it seems to belong.

***Machaerium floribundum* Benth. Journ. Linn. Soc. Bot. 4: Suppl. 68. 1860.**

A scandent shrub, climbing on high trees, the branchlets subangular, at first ferruginous-pubescent, later glabrous, the bark more or less rimose.

Leaves 3 to 9-foliolate, glabrous or almost so, the rachis 3 to 20 cm. long. Leaflets coriaceous, the petiolules thick, at first ferruginous-pubescent, 4 to 6 mm. long, the blades ovate or oblong, rounded at the base, abruptly short-acuminate, 3.5 to 13 cm. long, dark green and dull above, paler beneath, the costa and veins impressed on the upper face, very prominent beneath. Stipules lanceolate, acute, subindurate, 6 to 8 mm. long, often caducous.

Inflorescences terminal, paniculate, up to 40 cm. long, the rachis more or less ferruginous-pubescent, the branchlets often geminate, simple or ramified, the peduncles 1 to 6 cm. long, few to many-flowered. Bracts triangular-acute, about 5 mm. long, ferruginous-pubescent, usually caducous; bractlets orbicular, hairy, subpersistent. Flowers 6.5 to 7 mm. long, sessile or very shortly pedicellate. Calycinal bracts orbicular, fuliginous-pubescent, very small. Calyx campanulate, 3 to 4 mm. long, fuliginous-pubescent without, the teeth indistinct and irregular. Petals dull white; standard minutely pubescent without, the claw 1.5 to 2 mm. long, the blade oblong, attenuate at the base, bilobulate at the apex, 5 to 5.5 mm. long, about 4 mm. broad; wings glabrous, strongly inequilateral, unequal in size, the claw slender, 2 to 2.5 mm. long, the blade ovate, shortened on the vexillar side at the base, 5 mm. long, 2.5 to 3.5 mm. broad; carinal petals glabrous, falcate, auriculate, the claw as in the wings, the blade about 4 mm. long, 2 to 2.5 mm. broad. Stamens monadelphous, glabrous, the anthers ovoid or oblong. Ovary 1-ovulate, long-stipitate, densely fuliginous-pubescent, provided at the base with a very short tubular disk; style glabrous, oblique, about 1.1 mm. long.

Type from northern Brazil, in the Kew Herbarium. The above description from specimens collected in Santa Marta, Colombia, in flower, March, 1900, by H. H. Smith (no. 2039).

The Santa Marta specimens agree with Bentham's description, except in the size of the flowers (6 to 7 mm. long instead of 9.5 mm.) and in having the standard minutely fuliginous-pubescent, not glabrous, without. In the absence of the legume a nearer determination is hardly possible. In the Brazil and Guiana specimens the legume is 7.5 to 10 cm. long, glabrous, the seminal part incurved, 1.9 to 2.5 cm. long, the wing 2.6 to 3.6 cm. broad, the stipe 1.5 to 2 cm. long.

A specimen of the type collection of *Machaerium floribundum* var. *parviflorum* Benth. from Tarapoto, Peru, in the Gray Herbarium, is remarkable for its large, lanceolate, indurate-spinescent, recurved bracts, which seem to be persistent.

Machaerium glabratum Pittler, sp. nov.

FIGURE 53.

An armed shrub (or tree?), the branchlets at first sparsely ferruginous-pubescent, later glabrous, grayish, verruculose.

Leaves 13 or 15-foliolate, the rachis 3.5 to 14 cm. long, slender, angular, hairy along the dorsal side. Leaflets subcoriaceous, glabrous, the petiolules about 0.5 mm. long, the blades oblong, rounded at the base, more or less retuse at the apex, 7 to 15 mm. long, 3 to 5 mm. broad, dark green above, paler beneath; veins crowded, parallel, slightly arcuate, not anastomosed, running into the marginal nerve. Stipules indurate-spinescent, narrow and acute, glabrous, about 5 mm. long.

Inflorescence paniculate, terminal, broad, 20 to 35 cm. long, the branchlets longer than the leaves, the rachis more or less puberulous; peduncles (branchlets of the second order) solitary or ternate, 3 to 10-flowered, 0.5 to 1.5 cm. long. Bracts more or less indurate, triangular-acute, more or less pubescent, subcaducous; bractlets scarious, caducous. Pedicels more or less ferruginous-pubescent, 2 to 2.5 mm. long. Flowers about 8 mm. long. Calycinal bractlets orbicular, puberulous or glabrous, minutely ciliate, 2 to 2.5 mm. long and broad. Calyx campanulate, gibbous-dilated on the vexillar side, 5 mm. long, purple,

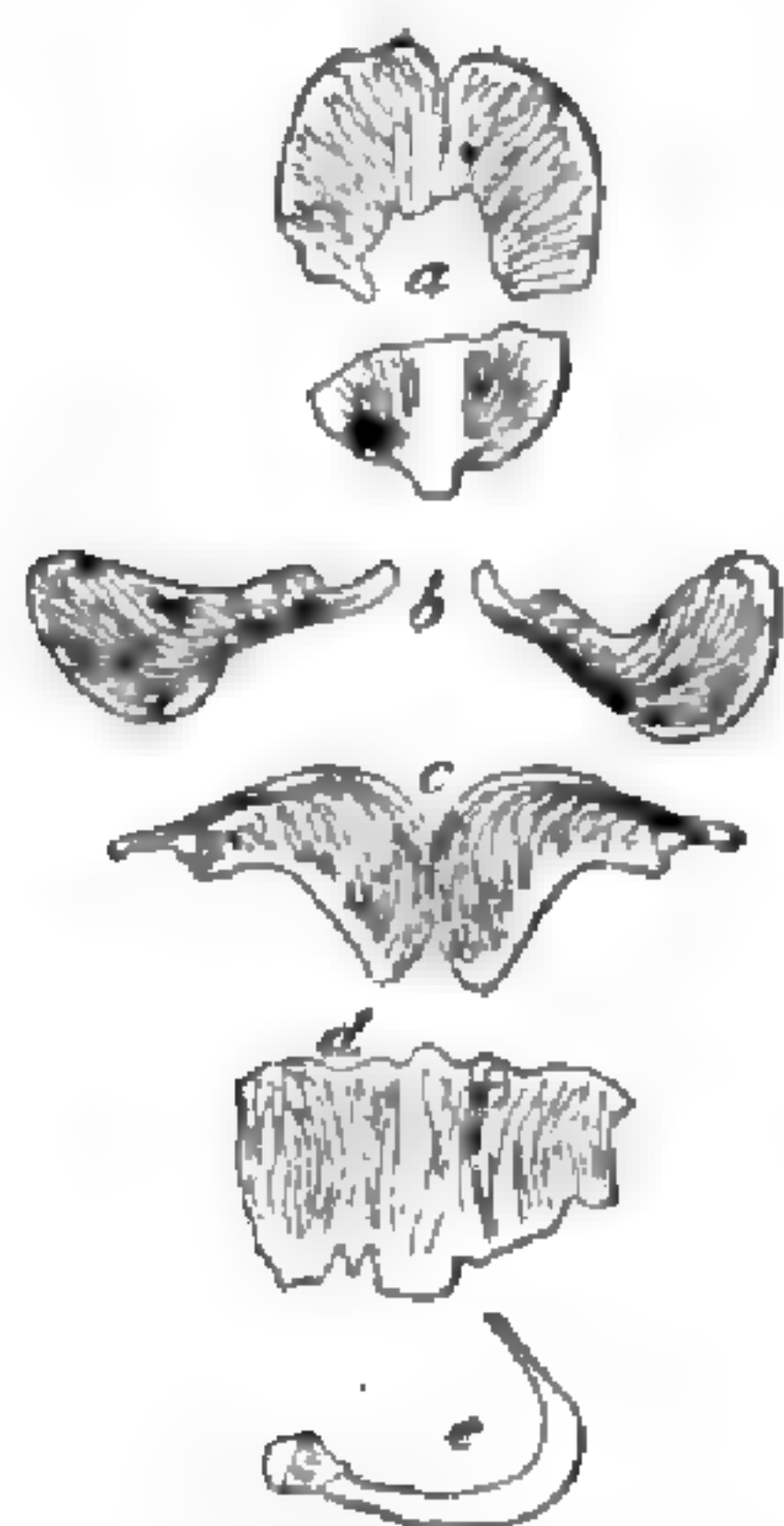


FIG. 53.—Floral details of *Machaerium glabratum*. a, Standard; b, wings; c, carinal petals; d, calyx; e, ovary. Natural size. From type specimen.

glabrous or minutely pilosulous, the teeth very short, rounded. Petals purple, glabrous; standard reflexed, ovate or obovate, the claw very short (hardly over 0.5 mm. long), the blade obovate or suborbicular, rounded at the base, rounded-emarginate at the apex, about 5.5 mm. long, 8 mm. broad; wings strongly oblique, arcuate, the claw 1.5 to 2 mm. long, the blade obovate, 1-auriculate at the base, obtuse, about 8 mm. long, 3 to 3.5 mm. broad; carinal petals strongly falcate-arcuate, the claw 1 to 1.5 mm. long, the blade 1-auriculate, subacute, about 9 mm. long, 3.5 mm. broad. Stamens monadelphous, the tube and filaments strongly arcuate, the anthers ovoid. Ovary 1-ovulate, stipitate at the base, flat-compressed, tomentellous or pubescent, provided at the base with a short tubular disk; style about 2.5 mm. long, glabrous.

Fruit not known.

Type in the U. S. National Herbarium, no. 532839, collected in Santa Marta, Colombia, in flower, in October, 1898, by H. H. Smith (no. 264). Other specimens by the same collector and from the same locality under no. 2032.

Distributed as *Machaerium acaciaefolium* Mart. This, according to Bentham, is the same as *M. angustifolium* Vog., the first name possibly having the priority. The Santa Marta shrub disagrees with the Brazilian species in the shape of the stipules and leaflets, the latter being smaller and paler on the lower face, in the size of the flowers, and in the short claws of the glabrous petals, the monadelphous stamens, the relatively light pubescence of the ovary, etc. Even conceding a very broad margin of variation to *M. angustifolium*, it is hard to see how these specimens could be identified with this species.

Machaerium humboldtianum Vog. *Linnaea* 11: 194. 1837.

FIGURE 54.

A tree 4 to 7 meters high (Humboldt) or a vine (Pittler), the branchlets terete, striate, glabrous, puberulous, or minutely pubescent.

Leaves 5 or 7-foliolate, glabrous or more or less pubescent, the rachis 5 to 9 cm. long, thickening at the base. Leaflets coriaceous, the petiolules subcanaliculate, 2 to 5 mm. long, the blades obovate, ovate, or elliptic, usually

rounded, sometimes cuneate at the base, obtuse or obtusely acuminate at the apex, 4 to 8 cm. long, 1.5 to 4 cm. broad, dark green above, paler beneath; costa impressed on the upper face of the leaflets, strongly prominent on the lower face; veins very numerous, parallel, more or less prominulous on both faces, simple to the marginal nerve or sparsely branching; intermediate veinlets more or less parallel to the veins and somewhat anastomosed. Stipules indurate-spinescent, arcuate, concave on the lower side, pilosulous or glabrous.

Inflorescence paniculate, terminal, 15 to 30 cm. long, loose, ramified, the rachis terete, more or less pilosulous or pubescent, 3 times ramified. Bracts spinescent, yellowish, pilosulous, arcuate (like the stipules). Peduncles (branchlets of third order) 3 to 10-flowered, provided at the base with scaly or spinescent bracts. Pedicels 2 to 3 mm. long, densely grayish-pubescent, bracteolate at the base. Flowers 9 to 10 mm. long. Calyx campanulate, 5-toothed, persistent, 5 to 5.5 mm. long, substriate, glabrous or sparsely pubescent without, the carinal tooth longer, narrow and acute, the lateral teeth broader, obtuse or acute. Calycinal bractlets suborbicular, glabrous or puberulous, up to 1.5 mm. long and broad, entire. Petals purple, glabrous or sparsely pubescent without; standard strongly reflexed, the claw 1 to 1.5 mm. long, the blade orbicular or ovate, obtuse, subtruncate, or attenuate at the base, emarginate with broadly rounded lobes at the apex, 7 to 9 mm. long, 8.5 to 9 mm. broad; claw of the wings 2 to 2.5 mm. long, the blade obliquely obovate, narrow and more or less distinctly auriculate on the vexillar side at the base, broad and obtuse at the apex, about as long as that of the standard, 2.5 to 3.5 mm. broad; carinal petals strongly falcate, the claw 2 to 2.5 mm. long, the blade broadly rounded-auriculate on the vexillar side, more or less obtuse at the apex, 7.5 to 8 mm. long, 3 mm. broad, the carinal margin more or less reflexed. Stamens monadelphous, the filaments arcuate, the anthers oblong. Ovary 1-ovulate, long-stipitate with a tubular disk at the base, compressed, appressed-villous or villous-tomentose, the style straight, glabrous, the stigma inconspicuous.

Fruit entirely glabrous, long-stipitate, the stipe slender, 7 to 10 mm. long, the whole 5 to 6.5 cm. long, the seminal part narrow (5 to 7 mm. broad), elongate, strongly veined, attenuate at the base, the wing oblong, cultriform, obtuse, apiculate (on the vexillar side of the apex), up to 16 mm. broad. Seed oblong, arcuate, compressed, brownish, about 15 mm. long, 4 mm. broad.

Type from the Aragua Valley, Venezuela, collected by Humboldt and Bonpland. Above description based upon specimens from near Colonia Tovar, *Fendler* 2226, for the leaves and flowers, and Valle del Limón, near Maracay, State of Aragua, Venezuela, *Pittier* 6077, for the fruit and seed.

The following specimens also belong here:

VENEZUELA: La Trinidad de Maracay, State of Aragua, flowers, February, 1913, *Pittier* 5791.

COLOMBIA: Santa Marta, alt. 170 meters, flowers and young fruits, April, 1901, *H. H. Smith* 2026 (distributed as *M. lineatum* Benth.).

All these specimens agree in a general way with Vogel's description, except in one important detail. Following Humboldt's notes, this author gives the plant the status of a tree, while, according to notes taken at the time of the collection of my own specimens, it is a scandent shrub. Further information on the habit of this species is desirable.

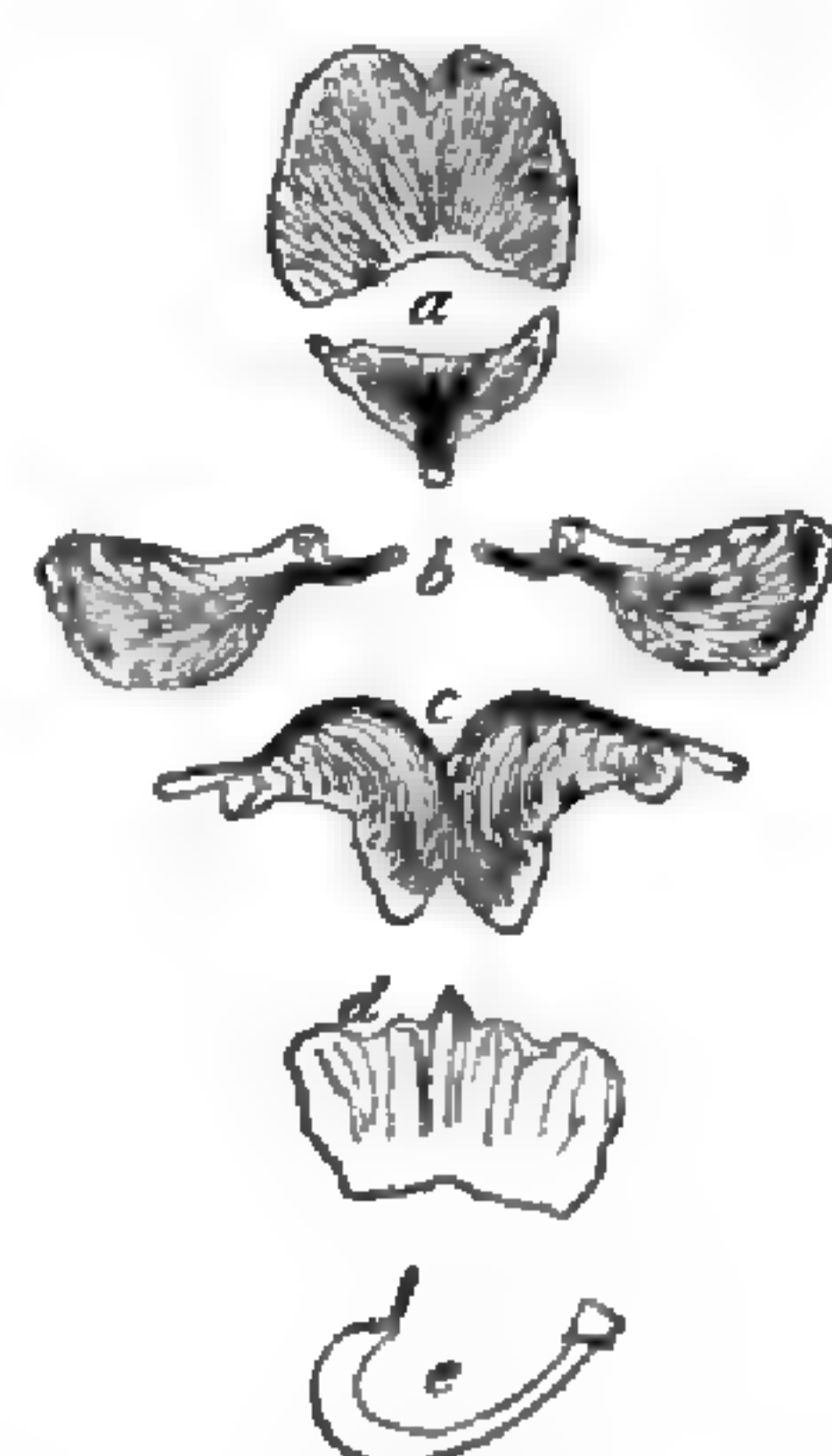


FIG. 54.—Floral details of *Machaerium humboldtianum*. a, Standard; b, wings; c, carinal petals; d, calyx; e, ovary. Natural size. From *Fendler* 2226 in Gray Herbarium.

According to Humboldt and Bonpland, *Machaerium humboldtianum* is known among the natives of the Aragua Valley under the names of "uña de gato," cat's claw, and "sangre de toro," bull's blood, the latter on account of the red gum which exudes from incisions made in the trunk.

Bentham attributes to this species subisadelphous stamens. As a matter of fact, they are always monadelphous structurally, the tube being opened above by a longitudinal slit which is ended at the base by a thick callous. The lower slit, which often divides the tube all through, is mechanical and the result more or less of the thickening of the ovary, so that the consequent division of the stamens into two apparent fraternities can not be considered as a real character of any species in the genus.

***Machaerium intermedium* Pittier, sp. nov.**

FIGURE 55.

An unarmed shrub or small tree, the branchlets verruculose, more or less ferruginous-pubescent.

Leaves 7 or 8-foliolate, the rachis slender, terete, sparsely ferruginous-hairy, 4.5 to 7 cm. long. Leaflets subcoriaceous, the petiolules ferruginous-hairy, 3 to 4



FIG. 55.—Floral details of *Machaerium intermedium*. a, Unopened flower; b, wings; c, carinal petals; d, calyx; e, ovary. Natural size. From type specimen.

mm. long, the blades ovate, ovate-oblong, or ovate-elliptic, rounded at the base, acuminate at the apex, 2 to 4.5 cm. long, 1 to 1.7 cm. broad, dark green on both faces, sublustrous and reticulate above and sparsely villosulous along the costa, glabrous or very sparsely villosulous beneath, sparsely ciliate. Stipules wanting.

Inflorescences axillary and terminal, the rachis fuscous-pubescent, 1.5 to 2 cm. long, ramified, the branchlets or peduncles about 1 cm. long, 5 to 7-flowered. Bracts caducous or wanting; bractlets very small, ovate, conchoid, pubescent, subpersistent. Flowers sessile, about 8.5 mm. long. Calycinal bractlets clasping, much broader than long, fuscous-pubescent, about 1.5 mm. long, 2 to 2.5 mm. broad. Calyx campanulate, 2.5 to 3.5 mm. long, fuscous-pubescent, the teeth small and uneven. Petals purple; standard thick, coriaceous, conchoid, minutely fuscous-pubescent without, the claw

about 0.7 mm. long, the blade suborbicular, rounded or subemarginate at the base, rounded and incised-emarginate at the apex, about 6 mm. long, 7 mm. broad, the margin incurved; wings long and narrow, fuscous-pubescent without along the middle, the claw about 2.5 mm. long, the blade scarcely auriculate, obtuse, 6 mm. long, 2.5 mm. broad; carinal petals falcate, fuscous-pubescent without along the carinal side, the claw as in the wings, the blade auriculate, obtuse, 6.5 mm. long, about 3 mm. broad, the vexillar margin almost straight. Stamens monadelphous, the carinal one longer, the filaments sparsely villous, the anthers oblong. Ovary 1-ovulate, stipitate, provided at the base with a glabrous tubular disk nearly 1.5 mm. long, the fuscous pubescence increasing in length from the base to the apex; style glabrous, straight, slender, about 2.5 mm. long.

Legume not known.

Type in the Gray Herbarium, collected in Santa Marta, Colombia, at an altitude of about 750 meters, 1898–1901, by H. H. Smith (no. 2038).

Very closely allied to *Machaerium seemannii* Benth. and *M. towarensense* Pittier (below), but differing from both in the pubescence, the average number of leaflets, and the size and indument of the flowers. Future investigations, based on more copious and complete material, may show that these three forms are not specifically distinct.

Machaerium madeirense Pittier, sp. nov.

A tree, the branchlets terete, at first densely ferruginous-pubescent.

Leaves 5 or 7-foliolate, the rachis puberulous, angular or terete, 4.5 to 8 cm. long. Leaflets coriaceous, the petiolules brownish-pubescent, thick, 4 to 6 mm. long, the blades ovate, broadly rounded or rounded-cuneate at the base, obtusely acuminate, 2 to 10 cm. long, 1.5 to 4.5 cm. broad, glabrous above, paler and minutely puberulous beneath. Stipules caducous, not seen.

Inflorescences terminal, paniculate, 15 to 20 cm. long, the rachis ferruginous-pubescent, the branchlets of the first order of peduncles 1.5 to 3 cm. long, 5 to 10-flowered. Bracts and bractlets caducous. Flowers short-pedicellate, the other details not known.

Legume 5.5 to 8 cm. long, short-stipitate (the stipe about 3 mm. long), sparsely ferruginous-pubescent all over, the seminal part small, 1 to 1.5 cm. long, 0.5 cm. broad, ovate, straight, the wing membranous, cultrate, obtuse, prominulous-reticulate, 11 to 12 mm. broad.

Type in the John Donnell Smith Herbarium, collected at the falls of the Madeira River, Brazil, in fruit, October, 1886, by H. H. Rusby (no. 1323).

Related perhaps to *Machaerium acuminatum*, but obviously distinguished from it by the pedicellate flowers and small pods.

Machaerium milleflorum Pittier, sp. nov.

FIGURE 56.

A shrub or small tree, scarcely armed, the young branchlets terete, ferruginous-tomentose.

Leaves 21 to 27-foliolate, the rachis slender, 9 to 12 cm. long, ferruginous-tomentose. Leaflets membranous, the petiolules ferruginous-hairy, 1 mm. long or less, the blades ovate-oblong, the terminal one obovate, oblique, rounded at the base, rounded, often emarginate, sometimes acute and mucronulate at the apex, 1 to 3 cm. long, 0.6 to 1.2 cm. broad, dark green and sparsely pilosulous above, sparsely villous or pilosulous beneath, the costa and margin more densely ferruginous-hairy; veins somewhat distant, irregular, profusely anastomosed, the principal ones running into the marginal nerve. Stipules rather small, indurate-spinescent, acute-lanceolate, glabrous and dark-colored, subpersistent.

Inflorescence paniculate, terminal, large (20 cm. long and broad or more), twice-branched, the rachis brownish-hairy or tomentellous; branchlets of first order 2 to 5-fasciculate, branched (or one simple, peduncle-like), 10 to 12 cm. long; peduncles cymoid, fasciculate at the nodes, slender, many-flowered, 1 to 3 cm. long. Bracts indurate-spinescent, glabrous, broad and acute, 2 to 3 mm. long; bractlets scarious, conchoid, purple, glabrescent, very small, persistent. Pedicels 1.5 to 2 mm. long, cano-pubescent. Flowers about 6 mm. long. Calycinal bracts suborbicular, conchoid, glabrous, about 1 mm. long, 1 to 1.5 mm. broad. Calyx campanulate, 3 to 3.5 mm. long, striate, purple, glabrous or minutely pilosulous, the teeth obtuse, about equal in length, but the vexillar ones broad. Petals pink (?); standard densely fulvous-hairy without, not reflexed, the claw obliquely inserted, about 1 mm. long, the blade orbicular, rounded or subtruncate at the base, deeply emarginate at the apex, the lobes rounded, about 5.5 mm. long, 6.5 mm. broad; wings broadly obovate, glabrous, 1-auriculate, subacute or obtuse, the claw 1.5 mm. long, the blade 4.5 mm. long, 3 mm. broad; carinal petals falcate, broad, with a straight vexillar margin, the claw as in the wings, the blade about 4.5 mm. long, 2.2 mm. broad. Stamens monadelphous, glabrous, the anthers ovoid. Ovary 1-ovulate,



FIG. 56.—Floral details of *Machaerium milleflorum*. a, Standard; b, wings; c, carinal petals; d, calyx; e, ovary. Natural size. From type specimen.

stipitate, slightly arcuate, densely cano-pubescent or fulvous-pubescent, provided at the base with a very short cuplike disk; style glabrous, about 1.3 mm. long.

Fruit not known.

Type in the U. S. National Herbarium, no. 704057, collected in Santa Marta, Colombia, 1898-9, by H. H. Smith (no. 2033).

This species is remarkable for the size and branching of its inflorescence and for its small, numerous flowers.

Machaerium moritzianum Benth. Journ. Linn. Soc. Bot. 4: Suppl. 58. 1860.

FIGURE 57.

A shrub or small tree, almost unarmed, the branchlets terete, at first ferruginous-pubescent.

Leaves 17 to 25-foliolate, the rachis slender, subcanaliculate, 7 to 10 cm. long, ferruginous-pubescent. Leaflets membranous or subcoriaceous, the petiolules hairy, not over 1 mm. long, the blades oblique-oblong, cuneate or somewhat rounded at the base; rounded-emarginate at the apex, 1.2 to 2.5 cm. long, 6 to 10 mm. broad, more or less puberulous on both faces, paler beneath; veins rather distant, running into the marginal nerve, but branched and distinctly anastomosed. Stipules broadly triangular, acute, indurate and subspinescent, very caducous.

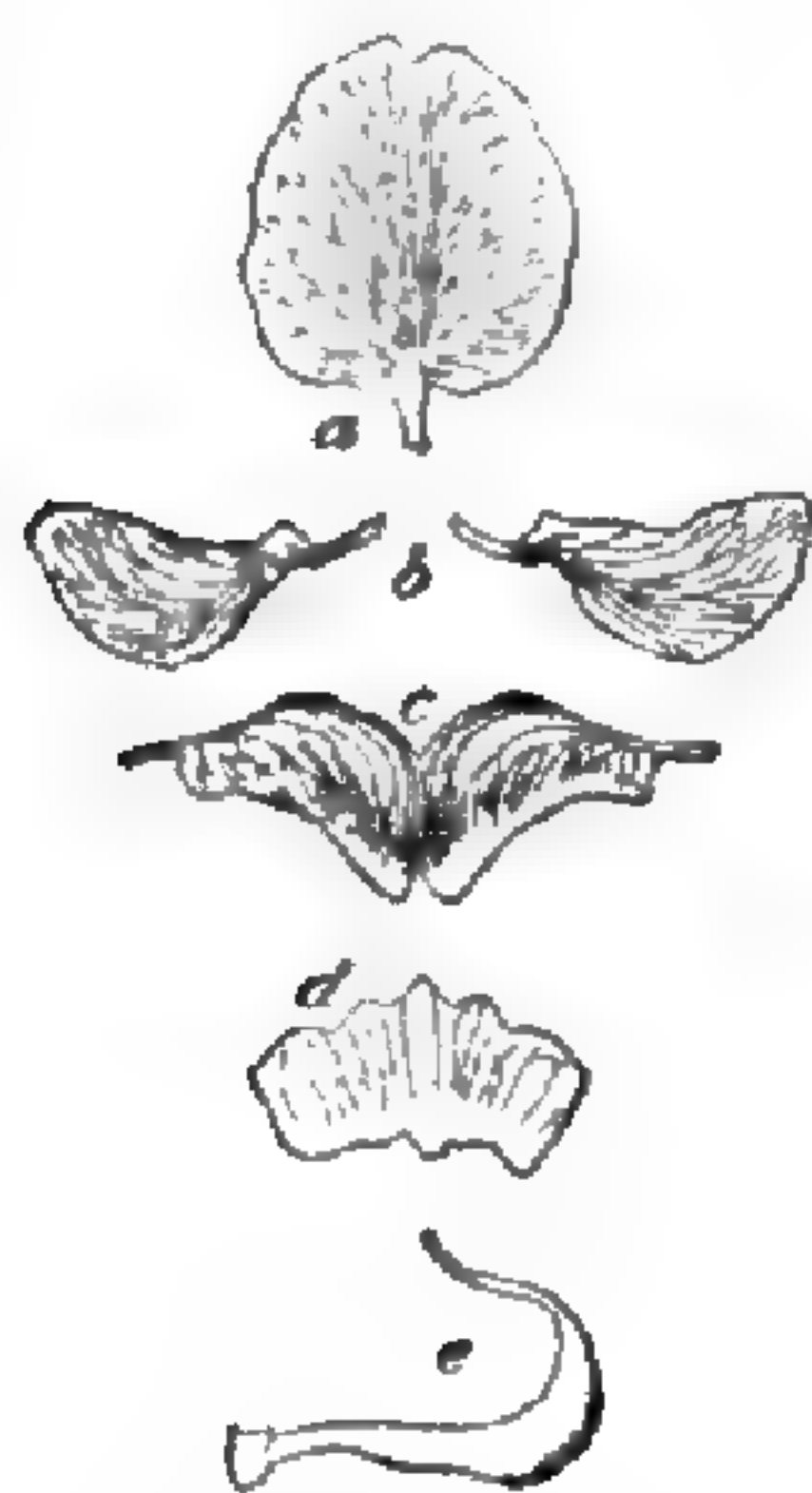


FIG. 57.—Floral details of *Machaerium moritzianum*. a, Standard; b, wings; c, carinal petals; d, calyx; e, ovary. Natural size. From Fendler 1750¹ in Gray Herbarium.

Inflorescence paniculate, axillary or terminal, 6 to 8 cm. long (shorter than the leaves), simple-branched, the rachis rufous-tomentose; peduncles solitary or in 2's or 3's, simple, 1 to 5-flowered, 1 to 2 cm. long. Bracts and bractlets not seen. Pedicels about 2 mm. long, rufous-hairy. Flowers 10 to 11 mm. long. Calycinal bractlets suborbicular or broader than long, ferruginous-pubescent, about 1.5 mm. long, 2 mm. broad. Calyx campanulate, 3 to 4 mm. long, pubescent, the vexillar teeth very broad and rounded, the carinal tooth slightly longer, acute. Petals purple, glabrous; standard reflexed, the claw about 2 mm. long, the blade ovate, broadly rounded at the base, rounded-emarginate at the apex, about 8 mm. long and 7.5 mm. broad; wings oblique, falcate, 1-auriculate, the claw 1.5 to 2 mm. long, the blade 7 mm. long, 3 mm. broad; carinal petals falcate, 1-auriculate, subacute at the apex, the claw 1.5 mm. long, the blade 7 to 7.5 mm. long, 3 mm. broad. Stamens monadelphous, glabrous, the filaments thick, the anthers small, ovoid. Ovary stipitate, strongly arcuate, densely villous-tomentose; style glabrous, about 5 mm. long.

Legume (fide Bentham) about 5 cm. long, the seminal part strongly bent, 10.5 to 11.5 mm. broad, the wing straight, about 17 mm. broad.

Type from Colonia Tovar, Venezuela, collected in flower by Fendler (no. 1750¹). The above description is after the specimen of this collection in the Gray Herbarium. The fruits, which I have not seen, were described from Fendler's specimens (no. 1866²) from the same locality or from Moritz's no. 883, also from Venezuela, without further indication of locality.

Other specimens of the same species have been collected at the foot of the Cordillera de Santa Marta, Colombia, by H. H. Smith (no. 14). In these the leaflets are coriaceous and much larger than in the type, but the floral characters agree perfectly. The pubescence of the leaves, also, is decidedly less marked.

The venation of the leaflets undoubtedly places this species among the Oblonga. According to Bentham the base of the pod is like that of a Drepanocarpus on a small scale, while the wing is that of *Machaerium*.

Machaerium towarensense Pittier, sp. nov.

An unarmed tree, the branchlets terete, striate, verruculose, at first densely fulvous-pubescent.

Leaves 11 or 13-foliolate, the rachis densely fulvous-hairy, 6 to 9 cm. long. Leaflets subcoriaceous, the petiolules densely hairy, about 1 mm. long, the blades ovate-oblong or elliptic, rounded at the base, attenuate and obtusely subacuminate at the apex, 1 to 5 cm. long, 1 to 2 cm. broad, above lustrous, pilosulous, the venation prominulous, beneath paler, reticulate, densely hairy on the costa and sparsely pilosulous on the veins, the margin also more thickly pilose-ciliate. Stipules caducous, not seen.

Inflorescences axillary or terminal, racemose, 1 to 2 cm. long, the rachis fulvous-tomentose. Calycinal bractlets fulvous-pubescent, broader than long. Calyx persistent, campanulate, truncate, 2 to 3 mm. long. Filaments long-ciliate. Other details of the flower wanting.

Legume 7 to 8.5 cm. long, short-stipitate (the stipe about 4 mm. long), ferruginous-pubescent, more so on the seminal part and along the carinal margin, the seminal part 2 to 3 cm. long, 1.3 to 1.5 cm. broad, almost straight, the wing cultrate, obtuse, mucronate, 2 to 2.7 cm. broad.

Type in the Gray Herbarium, collected near Colonia Tovar, State of Aragua, Venezuela, in fruit, by A. Fendler (no. 1865).

This collection was considered by Bentham to belong to his *Machaerium scemannii*, the description of the fruit being added to the original description of that species. But the general pubescence is much more abundant on the Venezuelan tree, the leaflets on the whole more numerous, with shorter petiolules, and the fruits considerably larger and more hairy. On the other hand, the two species have many common characters, among them the villous filaments, so that there can be no doubt as to their being closely related.

AN OLD AND A NEW SPECIES OF DREPANOCARPUS.

Drepanocarpus inundatus Mart.; Benth. Ann. Wien. Mus. 2: 96. 1838. FIGURE 58.

A low, unarmed tree or shrub, the branchlets terete, glabrous.

Leaves 5 to 8-foliolate, entirely glabrous, the rachis 5 to 10 cm. long. Leaflets subcoriaceous, the petiolules subcanaliculate, 3 to 4 mm. long, the blades ovate-elliptic, rounded or sometimes cuneate at the base, obtusely long-acuminate at the apex, 2.5 to 7 cm. long, 1 to 3 cm. broad, dark green above, paler beneath, the veins prominulous on both faces, elegantly anastomosed-reticulate beneath. Stipules aculeiform, 2 to 4 mm. long, very caducous.

Inflorescences axillary, subracemose, much shorter than the leaves, sparsely branched, the rachis more or less ferruginous-pubescent, not over 4 cm. long, the branchlets (peduncles) simple, 5 to 8-flowered, not over 2 cm. long, cymoid. Bracts stipule-like, very caducous; bractlets ovate, conchoid, pubescent without, about 0.5 mm. long, caducous. Flowers sessile, about 1 mm. long. Calycinal bracts suborbicular (broader than long), fuliginous-pubescent without, 1.5 to 2 mm. long, 2.7 mm. broad. Calyx campanulate, striate, about 3.5 mm. long, purple, fuliginous-pubescent without, the teeth equal in length, rounded-obtuse, the vexillar ones a little broader. Petals purple; standard orbicular, attenuate at the base into a short (not over 1 mm. long) claw,



FIG. 58.—Floral details of *Drepanocarpus inundatus*. a, Standard; b, wings; c, carinal petals; d, calyx; e, ovary. Natural size. From Bourgeau, no number, in U. S. National Herbarium.

slightly emarginate at the apex, 6.5 mm. long, 6 mm. broad, silky-pubescent without; wings oblong, oblique, broadly 1-auriculate, obtuse, slightly pubescent at the base, the claw 1.5 to 2 mm. long, the blade 4 to 4.5 mm. long; carinal petals slightly falcate, semihastate-auriculate, pubescent at the base and along the carinal margin, the claw as in the wings, the blade 4.5 mm. long, 2 mm. broad. Stamens monadelphous, glabrous, the anthers ovoid. Ovary 1-ovulate, almost straight, long-stipitate, provided at the base with a tubular disk, this about 1 mm. long, glabrous, the stipe glabrous, the ovary proper fuliginous-hairy; style glabrous, recurved, about 1.3 mm. long.

The following specimens have been examined:

MEXICO: Córdoba Valley, State of Veracruz, 1865-6, *Bourgeau*.

EL SALVADOR: Southern slopes of Santa Ana Volcano, alt. 1,000 meters, flowers, February 18, 1907, *Pittier* 2057.

Drepanocarpus venezuelensis Pittier, sp. nov.

FIGURE 59.

A low, bushy, half-trailing shrub, unarmed, the branchlets terete or more or less longitudinally sulcate, with reddish brown, rimose bark, the younger parts minutely appressed-pubescent.

Leaves 7 to 11-foliolate, the rachis 6 to 12 cm. long, at first ferruginous-pubescent, later glabrescent. Leaflets coriaceous, the petiolules ferruginous-pubescent or glabrescent, 4 to 5 mm. long, the blades oblong, rounded or subcuneate at the base, obtusely acutate or subacuminate at the apex, 5 to 11 cm. long, 1.5 to 3.5 cm. broad, dull, glabrous, and prominulous-reticulate above, paler, minutely appressed-pilosulous, and reticulate beneath, the costa and veins impressed above, very prominent beneath. Stipules ovate-acuminate, 2 to 4 mm. long, coriaceous, puberulous without, caducous.



FIG. 59.—Floral details of *Drepanocarpus venezuelensis*. a. Standard; b. wings; c. carinal petals; d. calyx; e. ovary. Natural size. From type specimen.

Inflorescences paniculate, axillary or terminal, the rachis ferruginous-pubescent, the secondary branchlets (5 to 11 cm. long) and the peduncles often fasciculate at the nodes; peduncles simple or ramified, 5 to 8-flowered, 1 to 3 cm. long. Bracts ovate-acuminate, ferruginous-pubescent, about 2 mm. long, caducous; bractlets obovate, very small, hairy, subpersistent. Flowers sessile, 8 to 9 mm. long. Calycinal bractlets ovate to obovate, 1 to 2 cm. long, 1 to 5 mm. broad, ferruginous-pubescent. Calyx campanulate, 4 to 5 mm. long, minutely ferruginous-pubescent, the teeth very short, rounded and broad. Petals white with purple veins; standard straight (not reflexed), minutely ferruginous-pubescent without, the claw broad, about 2.5 mm. long, the blade ovate, attenuate at the base, rounded and broadly emarginate at the apex, about 6 mm. long and 5 mm. broad; wings glabrous, strongly oblique, the claw slender, 2.5 to 3 mm. long, the blade ovate, shortened at the base on the vexillar side, obtuse at the apex, 5.5 to 6 mm. long, 2.5 to 3 mm. broad; carinal petals strongly falcate, glabrous, the claw as in the wings, the blade about 5 mm. long, 2 to 2.5 mm. broad. Stamens monadelphous, glabrous, the filaments thick, the anthers small, subglobose. Ovary 1-ovulate, long-stipitate (stipe 3.5 to 4 mm. long), brownish-pubescent, provided at the base with a very short tubular disk; style glabrous, straight, about 1.1 mm. long.

Legume not known.

Type in the U. S. National Herbarium, no. 601838, collected at El Cedral de las Ajuntas, near Los Tegues, State of Miranda, Venezuela, in flower, April 27, 1913, by H. Pittier (no. 6108).

Collected also near Colonia Tovar, State of Aragua, 1856-7, by A. Fendler (no. 2318).

Fendler's specimen was first determined by Benthams as *Drepanocarpus* and later as *Machaerium leiophyllum* Benth. It has certainly very little in common with the latter, while its habit, the shape of the long, unguiculate petals, and the absence of any appearance of a wing in the developed ovaries all point to the former genus.

This shrub is known among the natives under the name of "chaperno."

TWO NEW SPECIES OF PTEROCARPUS FROM COLOMBIA.

Pterocarpus floribundus Pittier, sp. nov.

FIGURE 60.

A tree, the branchlets glabrous, lenticellate.

Leaves 3 or 5-foliolate, the rachis slender, flattened above, 5 to 8 cm. long, glabrous. Leaflets membranous, the petiolules terete, 4 to 6 mm. long, more or less puberulous or pubescent, the blades ovate, rounded or abruptly acuminate at the base, obtusely long-acuminate at the apex, 9 to 12 cm. long, 4.5 to 7 cm. broad, glabrous, minutely reticulate, paler beneath and the veins prominent.

Panicle terminal, many-branched, oblong, 20 to 25 cm. long, abundantly flowered, the main rachis grayish, glabrous, the rachis of the lateral racemes 4 to 6 cm. long, densely ferruginous-hairy. Bracts very small, obtuse, hairy. Flowers pedicellate, the pedicels 3 to 4 mm. long, ferruginous-hairy, provided at the apex with 2 opposite, linear-acute bractlets about 1 mm. long and contiguous to the calyx. Calyx turbinate-campanulate, narrow, oblique, 5 to 7 mm. long, ferruginous-pubescent without, persistent, the teeth acute. Petals glabrous, yellow; standard suborbicular, attenuate and purple at the base, the claw cuneate, about 4.5 mm. long, the blade broader than long, about 9 mm. by 14 mm.; wings oblique, broadly ovate, the claw slender, about 4.5 mm. long, the blade 1-auriculate at the base, broadly rounded at the apex, about 10 mm. long and 7 mm. broad; carinal petals coherent along the lower margin, subfalcate, the claw 3.5 to 4 mm. long, the blade oblique-oblong, 1-auriculate, obtuse at the apex, about 8 mm. long, 4 to 4.5 mm. broad. Stamens glabrous, monadelphous, the filaments free for about half their length; anthers oblong. Ovary sessile, 4-ovulate, ferruginous-tomentose, the style glabrous, about 10 mm. long.

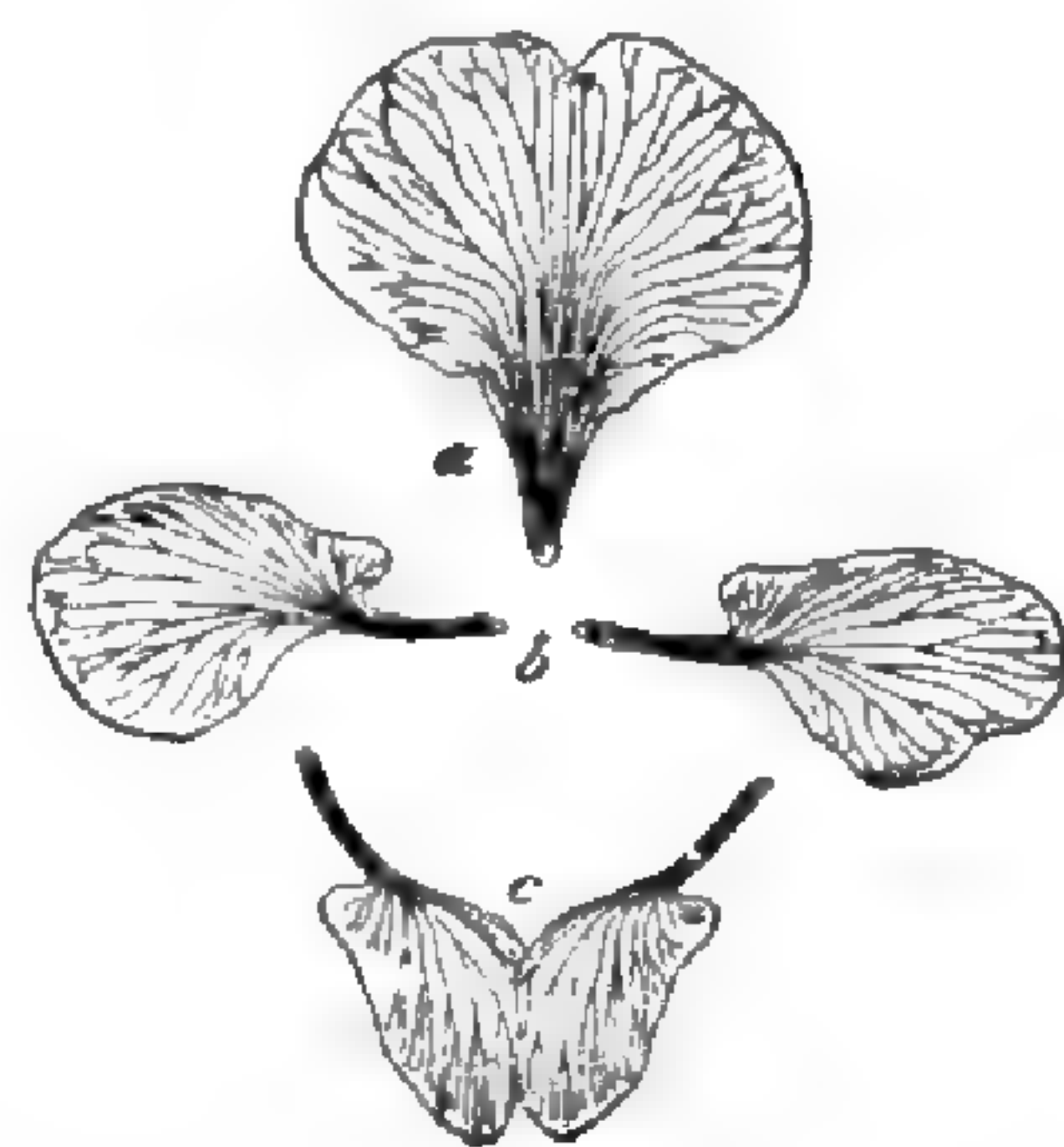


FIG. 60.—Petals of *Pterocarpus floribundus*. a, Standard; b, wings; c, carinal petals. Natural size. From type specimen.

Immature fruits orbicular, apiculate laterally.

Type in the U. S. National Herbarium, no. 704056, collected in Santa Marta, Colombia, 1898-9, by H. H. Smith (no. 2030).

This beautiful species seems to be very closely related to *P. rohrii* Vahl from the same region, differing mainly in the disposition of the inflorescence, the shape and reduced number of the leaflets, the small dimensions of the flowers, and the 4-ovulate ovary.

Pterocarpus heterophyllus Pittier, sp. nov.

FIGURE 61.

A tree, the branchlets pilosulous, sparsely lenticellate.

Leaves 5 to 9-foliolate, the rachis slender, glabrous or pilosulous, 6 to 12 cm. long. Leaflets coriaceous, very variable in size; petiolules more or less villous, 3 to 4 mm. long; blades ovate, rounded, truncate, or sometimes subemarginate at the base, emarginate at the apex, 1.5 to 8 cm. long, 1.5 to 4 cm. broad,

glabrous, reticulate, dark green above, paler or almost glaucous beneath, the venation prominent on both faces.

Racemes simple, 10 to 15 cm. long, growing from the axils of the upper leaves, the rachis more or less rufous-pubescent. Flowers very large for the

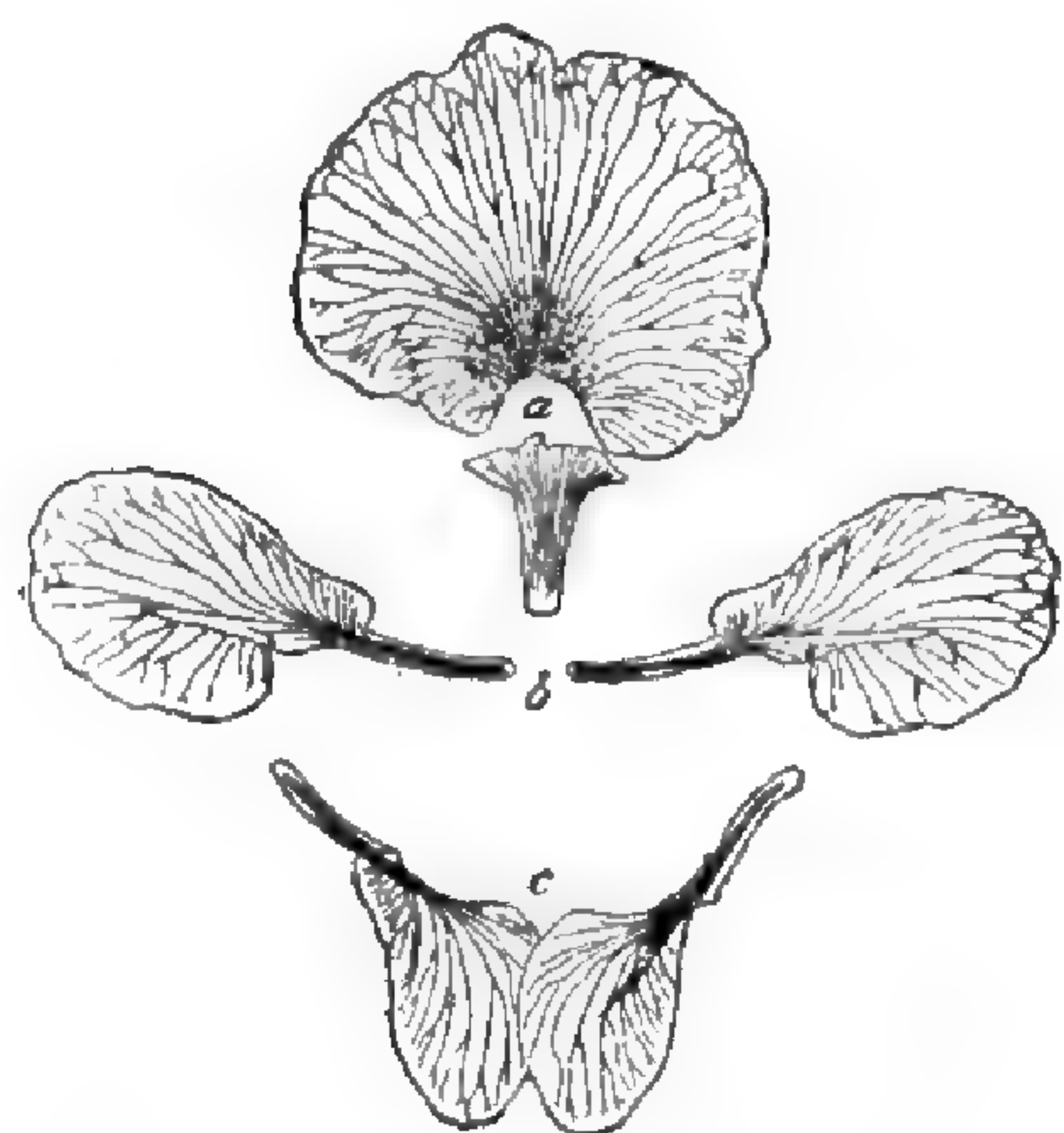


FIG. 61.—Petals of *Pterocarpus heterophyllus*. a, Standard; b, wings; c, carinal petals. Natural size. From type specimen.

genus, solitary, geminate, or 3 or 4-fasciculate along the rachis; pedicels slender, 1 to 1.5 cm. long, rufous-pubescent, provided above the middle with 2 very small, alternate, hairy bractlets. Calyx turbinate-campanulate, oblique, 8 to 10 mm. long, minutely rufous-pubescent, persistent, the lobes rounded-obtuse. Petals glabrous, yellow with dark purple veins; standard reflexed, the claw rather narrow, 4 mm. long, the blade suborbicular, more or less distinctly emarginate at the broadly rounded apex, about 12 mm. long, 17 mm. broad; wings free, the claw slender, 5 to 6 mm. long, the blade ovate, 12 mm. long, 8.5 mm. broad; carinal petals cohering along the lower margin, the claw about 5.5 mm. long, the blade oblique-obovate, about 10 mm. long, 5.5 mm. broad. Stamens monadelphous, the free part of the fila-

ments very short, the anthers ovate, dark brown. Ovary long-stipitate, 5 or 6-ovulate, rufous-villous, the style glabrous, slender, about 8 mm. long.

Legume orbicular, stipitate, 1-seeded, more or less pubescent or glabrescent, reticulate, 5 to 5.5 cm. in diameter. Seed (immature?) obovate-elliptic, compressed, 7 mm. long, 3.5 mm. broad.

Type in the U. S. National Herbarium, no. 703743, collected in Santa Marta, Colombia, 1898-9, by H. H. Smith (no. 16).

This differs obviously from the other *Pterocarpus* species known from the same region in the shape of the leaflets and the size of the flowers. The staminal tube is often split into two parts as the ovary grows, the stamens thus becoming apparently isadelphous. The type specimen shows a wide variation in the size of the leaflets, but it is likely that taken all together and full grown on a whole tree, they would show more or less decidedly the larger dimensions indicated above.

AN OLD AND A NEW SPECIES OF PLATYMISCIUM.

Platymiscium polystachyum Benth. in Seem. Bot. Voy. Herald 111, pl. 21. 1853.

A middle-sized or large tree, forking low, with a rounded crown. Bark of the trunk grayish and rough, that of the branchlets brownish gray, densely dotted with minute lenticels.

Leaves opposite or ternate, imparipinnate, 3 or 5-foliolate, glabrous; leaflets opposite, short-petiolulate, coriaceous. Leaflet blades ovate, rounded at the base, 5 to 22 cm. long, 2 to 10 cm. broad, more or less abruptly narrowed at the apex into an obtuse acumen, finely reticulate, light green and shining above, paler beneath; costa and primary veins prominent beneath. Stipules orbicular-obtuse, caducous.

Racemes simple, 7.5 to 10 cm. long, glabrous, geminate or rarely solitary in the defoliate axils of last year's growth, appearing before the new leaves; rachis (peduncle included) 15 to 20 cm. long. Flowers numerous, 13 to 14

mm. long. Pedicels filiform, 5 to 10 mm. long, provided at the base with small, rounded, caducous bractlets. Calyx campanulate, 6 to 7 mm. long, bearing at the base 2 ovate bractlets about 1 mm. long; teeth subequal, irregular, minutely ciliate. Petals yellow; standard ovate-orbicular, attenuate into a slender claw, about 13 mm. long and 11 mm. broad; wings narrowly unguiculate, auriculate, ovate-elliptic, rounded at tip, 12 to 13 mm. long, 4 to 6 mm. broad; carinal petals cohering at the apex and nearly of the same size and shape as the wings. Stamens about 10 mm. long, the vexillar one free almost to the base; anthers ovate, apiculate. Ovary long-stipitate, 1-ovulate, glabrous; style slender, incurved.

Legumes few or single on each rachis of the inflorescence, elliptic, rounded at both ends, 9 cm. long, exclusive of a stipe 1 cm. long, 3.5 broad; pedicel 6 mm. long. Mature seed not seen.

Type in the Kew Herbarium.

The following specimens are of this species:

PANAMA: David, Chiriquí, a fine tree, producing a beautiful wood (Seemann). Hospital grounds at Ancón, Canal Zone, flowers, February, 1912, *Pittier* 5724. Río Congo, southern Darién, fruit, June, 1914, *Pittier* 6988.

COSTA RICA: Currés, on the banks of the Diquís River, near Boruca, Province of Puntarenas, alt. about 100 meters, a small tree, the trunk 15 to 20 cm. in diameter, in flower, March 4, 1898, *Pittier* (Inst. Fís. Geogr. Costa Rica, no. 11954).

Reported also from Colombia and Venezuela.

Bentham gave only a short diagnosis of this species, this accompanied with a plate, which is excellent in every detail but for the lack of fully developed leaflets. The present description is founded mostly on my specimens from Panama, in small part on the Costa Rican ones, which were first identified by Captain John Donnell Smith. There are small discrepancies between Bentham's drawing and my specimens; in the latter, for instance, the pedicels are mostly slender and much longer than the calyx, and the standard is slightly emarginate. The Costa Rican specimens were from a small tree and have no mature leaves.

***Platymiscium dubium* Pittier, sp. nov.**

A middle-sized tree, forking low, with rounded, depressed, or elongate crown. Bark grayish, finely lenticellate on young twigs.

Leaves opposite, 5 or 7-foliolate, imparipinnate, entirely glabrous; rachis terete, 8 to 10 cm. long. Leaflets coriaceous, glabrous, opposite or nearly so, light green above, paler beneath; petiolules thick, slightly canaliculate, 4 to 6 mm. long; blades ovate to elliptic-lanceolate, broader and rounded at the base, acuminate at the apex, the lateral ones 5 to 9 cm. long, 2 to 4 cm. broad, the terminal one usually a little larger (9 to 11 cm. long, 4 to 5 cm. broad). Stipules semiorbicular, thick, caducous.

Racemes simple, short (3 to 7 cm. long), axillary. Flowers not known.

Pod thin, coriaceous, elliptic, rounded at both ends, 6 to 8 cm. long, 2 to 2.5 cm. broad, glabrous, the stipe about 7 mm. long, the pedicel not over 5 mm. long. Seed elongate, subreniform, flat, 7 mm. long, 3 mm. broad.

Type in the U. S. National Herbarium, no. 679925, collected near Chepo, Panama, at about 60 meters above sea level, in fruit, October, 1911, by H. Pittier (no. 4762).

Although it goes under the same common name of "quira," of Indian origin, this species can not be confused with *Platymiscium polystachyum* Benth., from which it differs obviously in habit as well as in the number, size, and texture of

the leaflets and the size and shape of the legume. On the other hand, the specimens, though incomplete, seem not to agree with any other species in the genus, so that even in the absence of the flowers it seems safe to regard them as representing a hitherto undescribed species.

A NEW VENEZUELAN SPECIES OF CLITORIA.

Clitoria dendrina Pittier, sp. nov.

FIGURE 62.

A small tree, 4 to 5 meters high, the limbs ascending, the branchlets slightly pubescent or glabrate.

Leaves 3-foliolate, the rachis subangular, more or less tomentose-pubescent, 9.5 to 18 cm. long, the petiolar part about 6 times as long as the interfoliolar part. Leaflets thick, the petiolules terete, tomentose-pubescent, 7 to 9 mm. long, the blades broadly ovate or rhomboid-ovate, rounded or subcuneate at the base, obtuse or subacute at the apex, 8 to 12 cm. long, 8 to 10 cm. broad, puberulous above, the costa and veins more or less impressed, beneath paler, tomentose-pubescent, the costa, veins, and transverse veinlets brownish and strongly prominent. Stipules and stipels caducous, not seen.

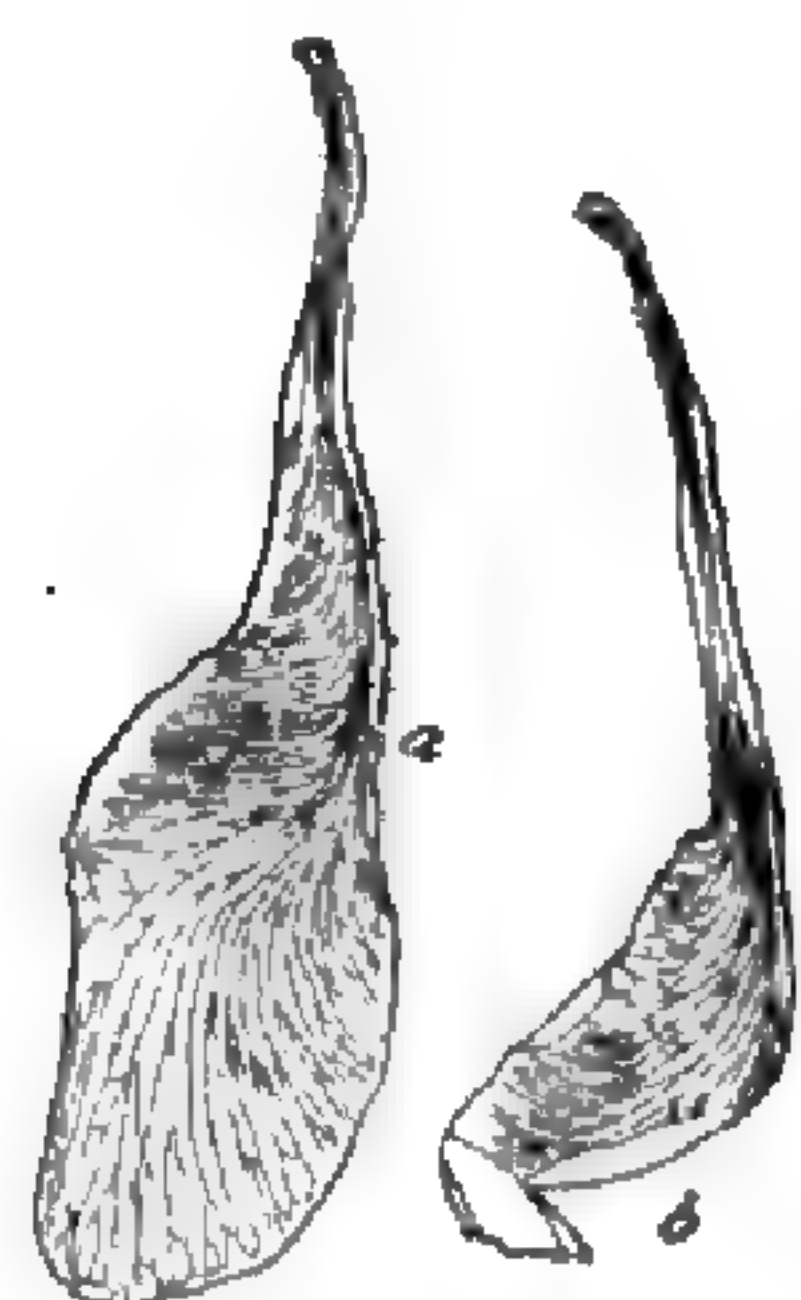


FIG. 62. — Petals of *Clitoria dendrina*. a, Wing; b, carinal petal. Natural size. From type specimen.

Inflorescence terminal, short-branched, many-flowered, the rachis about 4 cm. long, grayish-hairy; floral pedicels 5 to 7 mm. long, pubescent, the basal bractlets oblong-lanceolate, hairy, 1 to 2 mm. long. Flowers about 4.5 cm. long. Calycinal bractlets ovate, acute, about 3 mm. long and 2 mm. broad, pubescent. Calyx tubular, 12 to 14 mm. long, pubescent without, the teeth short (about 4 mm. long), ovate-acute. Petals dark purple, pubescent without, persistent; standard obovate, attenuate to the base, emarginate at the apex, about 3.5 cm. long, 3 cm. broad; wings long-unguiculate, the claw about 9 mm. long, the blade oblique-obovate, obtuse at the apex, 19 to 20 mm. long; carinal petals coherent at the apex, the claw slender, about 15.5 mm. long, the blade falcate, 9.5 mm. long, 4.5 mm. broad. Staminal tube 18 mm. long, straight, the free part of the filaments 1 to 3 mm. long, abruptly bent; anthers ovoid; vexillar stamens free at the base. Ovary substipitate or sessile, about 14 mm. long, tomentose, about 12-ovulate; style long, recurved, hispidulous almost to the capitellate stigma.

Legume pedicellate, stipitate, glabrous; pedicels thick, about 1 cm. long, glabrescent; stipe 2.5 to 3 cm. long, 3 mm. thick, pubescent, geniculate at the apex; legume proper linear-elongate, flat, attenuate at the base, apiculate at the apex, 18 to 25 cm. long, about 1.5 cm. broad, dark brown without, whitish within, the sutures slightly thickened. Seeds lenticular, brown, about 7 mm. in diameter, inserted on a broad, triangular placental expansion.

Type in the U. S. National Herbarium, no. 601479, collected along Río Limón, near Maracay, State of Aragua, Venezuela, at an altitude of 440 meters, in flower and fruit, January 27, 1913, by H. Pittier (no. 5773).

This species, which is a real tree, growing quite independently of the surrounding vegetation, belongs in the section *Clitorianthes* Benth., in the subdivision characterized by having the floral bractlets much shorter than the calyx. The only other species of this group reported so far from Venezuela is *C. javitensis* (H. B. K.) Benth., in which the stems are also thick and woody but climbing or trailing, the bractlets lanceolate, not ovate, and the leaflets glabrous or glabrescent, ovate or elliptic, and acuminate.

EUPHORBIACEAE.

OLD AND NEW SPECIES OF SAPIUM.

Sapium caudatum Pittier, sp. nov.

A medium-sized deciduous tree, about 15 meters high, the trunk 35 cm. in diameter at base. Ramification radio-fasciculate. Bark gray, with longitudinal fissures. New growth, leaves, and inflorescences entirely glabrous. Young foliiferous and floriferous shoots green, subangulate.

Leaves 3 to a cycle, erect; petioles 2 to 4.5 cm. long, rounded below, obscurely sulcate above; glands close to the lamina, short, conical, almost contiguous; blades 9 to 16 cm. long, 2.3 to 4 cm. broad, lanceolate, more or less rounded at the base, narrowing at the upper end into a long, slender, incurved tip; margin distinctly serrate, subrevolute, bearing many hydathodal teeth; venation forming a pale yellow net on the upper face of the leaf; costa prominent beneath; primary veins 8 to 10 mm. apart, arcuate. Stipules very small, obtuse, scaly.

Spikes often over 30 cm. long, solitary, tapering to an extended, slender, sterile cauda. Floral glands paired, not contiguous, ovate, purple. Female flowers 8 to 14; involucral bracts 3, broadly triangular or narrow, scarious, with smooth margin; perianth not apparent; ovary sessile, globose, obscurely sulcate; stigma sessile, its 3 reflexed branches early caducous. Male flowers in clusters of 5 to 14; bract triangular, much broader than long, more or less obtuse at tip, and with a scarious margin; bracteoles thin, irregular, or often undeveloped; perianth globose-campanulate, pink, about 1.7 mm. long, bilobulate, one of the lobules denticulate, covering the end of the other one between the stamens; stamens connate at the base and then diverging; filaments 2 to 2.5 mm. long, green, rather thick; anthers 2-celled, globose, purple.

Capsules 3 to 6 on each spike, small, depressed-globose, sessile, smooth, the divisions of the carpels well marked and their dorsal sutures obsolete. Seeds small (about 5 mm. long and broad), flattened, orbicular and almost heart-shaped, slightly tuberculate, the median line marked by a very thin raphe.

Type in the U. S. National Herbarium, nos. 678781 (flowers), 679149 (fruit), and 676760 (autumnal leaves), collected on a hill near Gamboa, Canal Zone, Panama, from a single tree, in flower, June 25, 1911, in fruit, July 23, 1911, by H. Pittier (nos. 3713, 4058, and 2603).

This species, which belongs to the group Cucullata of the section Americana Pax & Hoffm., was described from living specimens, the details being checked up later on material preserved in alcohol and on herbarium specimens. At my first acquaintance with the tree it was fast losing its leaves, previous to spring budding. In the specimen then collected (no. 2603, February 1, 1911), the leaves are coriaceous, olive-green above, whitish and scaly beneath; the petioles are very long and the blades large. Every tooth of the leaves which accompany the flowers ends in an easily caducous, conical, nectariferous gland, which does not seem to be the object of any special attention on the part of ants or other insects.

The examination of many sections of the cucullate appendage at the tip of the leaf showed a thickening of the epidermis on the upper side, but failed to indicate the presence of any glandular tissue; so that the term "apical gland," often used in the description of species of this genus, may after all be a misnomer. These appendages may serve other purposes than the feeding or sheltering of insects, and are met with in other plants distant generically, as for instance, in the banana (*Musa sapientum*), in which they appear in the young leaves but disappear as soon as the blade begins to unroll.

My frequent visits to the Gamboa *Sapium* tree allowed me to observe again the presence, already noticed in Costa Rica on *S. thelocarpum*, of large drops of water hanging in the early morning, even when there was no trace of dew, along the margins of the leaves. These leaves have evidently an unusual secretional power, which I have been led to locate in the larger, rounded teeth which appear at irregular intervals on their margin in several, if not all, species of the genus, and which seem to be real hydathodes, with an apical pore, the opening of the aquiferous duct, often so large as to be distinguished by the naked eye.

The extreme length of the floral spikes is one of the striking characters of *S. caudatum*. The basal flowers are often abortive, totally or in part, and the end of the rachis is long and slender, showing only imperfect clusters of male flowers. In the living specimens as well as in the dried ones, I have been unable to find any trace of a perianth on the female flowers. In the male flowers it was noticed that the stamens develop one at a time and that anthesis starts either at the base or in the middle of the cluster.

This species has its affinities with the group of *S. oligoneurum*, characterized by sessile capsules, coriaceous leaves, and long, slender spikes. It differs from the other species of the group by its lanceolate leaves, its very long spikes, the absence of perianth in the female flowers, and the larger number of male flowers in each cluster.

***Sapium giganteum* Pittier, sp. nov.**

A large tree, about 30 meters high, the trunk 1 meter in diameter at base. Trunk straight, 8 meters high, the limbs divaricate, twisted, forming a rather flat, spreading crown. Bark grayish and rimose.

Leaves coriaceous, glabrous; petioles 1.4 to 2 cm. long, terete, shallow-sulcate, the glands rounded-conical, contiguous to the base of the blade and hardly diverging; blades 5 to 12 cm. long, 2.5 to 3.5 cm. broad, elliptic, rounded-cuneate at the base, narrowing at the apex to a slender, incurved appendage; costa prominent beneath, the primary veins 4 to 7 mm. apart, salient on both faces, straight at the base and then abruptly arcuate; margin sinuate-dentate or, close to the apex, serrate. Stipules not known.

Inflorescence not known.

Fructiferous spikes bearing 4 to 8 capsules, these sessile, depressed-globose, about 10 mm. long by 15 mm. in diameter, the divisions of the carpels and their dorsal sutures equally well marked by longitudinal furrows. Seeds surrounded by a red pseudo-aril, whitish, suborbicular and depressed, paucituberculate, apiculate, about 5 mm. long by 5.8 mm. broad.

Type in the U. S. National Herbarium, no. 679239, collected near Fató, Province of Colón, Panama, at sea level, in fruit, August 10, 1911, by H. Pittier (no. 4141).

Closely allied to *S. caudatum*, with which it could be identified but for the large size of the tree, its smaller, thicker leaves, with different margins, the primary veins more inflexed, the apical appendages longer and more slender, and the different size and shape of the capsules and seeds.

Sapium giganteum is one of the largest and most conspicuous trees in the forests around Fató, or Nombre de Dios, on the San Blas Coast of Panama.

***Sapium aucuparium moritzianum* (Klotzsch) Pittier.**

Sapium moritzianum Klotzsch in Seem. Bot. Voy. Herald 100. 1853.

A tree, 5 to 10 meters high, with a more or less rounded-depressed crown and spreading branches. Floriferous branchlets erect. Bark rugose, gray.

Leaves coriaceous and stiff, olive-green above, darker beneath; petioles 5 to 15 mm. long, rounded on the back, flattened and broadly shallow-sulcate above; petiolar glands conical, erect (i.e., not divergent) and wide apart;

blades lanceolate or obovate-lanceolate, 6 to 13 cm. long, 1.3 to 2.5 cm. broad, rounded or broadly cuneate at the base, more or less obtuse or acute at the apex, with an incurved tip; margin finely and distinctly serrulate, each tooth bearing a dark, caducous nectarial gland; marginal hydathodes more or less numerous, in the shape of broad, rounded teeth; costa impressed above, salient beneath, as also the numerous slender, arcuate primary veins. Stipules ovate-reniform, fimbriate on the margin.

Spikes about 10 cm. long, solitary, terminal, androgynous or rarely only male; floral glands oblong; bracts broadly ovate-obtuse, fringed on the margin; bracteoles reduced to hairlike appendages. Female flowers 6 to 8, distant; perianth bilobulate; ovary globose; stigmas 3, sessile. Clusters of male flowers close together, 7 to 12-flowered; perianth yellowish, 2-cleft; stamens 2.

Capsules 3 to 6 on each spike, sessile, ovoid to depressed-globose, 10 mm. long, 13 mm. in diameter, the sutural furrows distinct, the septal ones obsolete. Seeds lenticular, apiculate, smooth, about 6 mm. long and broad.

The following specimens are of this subspecies:

PANAMA: Southern parts of the Province of Panama, *Seemann* 1243. Peña Prieta near Panama City, close to the sea beach, fruit, July 29, 1911, *Pittier* 4070. Sabana de Dormisolo near Chepo, Province of Panama, leaves only, October, 1911, *Pittier* 4659. Around Aguadulce, Province of Coclé, near sea level, leaves only, December, 1911, *Pittier* 4951.

This form has already been considered by both Dr. Huber and Dr. Pax as being possibly a mere variety of *S. aucuparium* Jacq., with which its affinities are indeed so very close that our specimens seem to be nearer Jacquin's original type than is *H. H. Smith* 1916, cited by Pax under *S. aucuparium*. From this they differ in having the leaves distinctly alternate and longer, narrower, and more acute at the tip, the petioles shorter, the blades thicker, and the margin conspicuously serrate. In the Aguadulce specimens, however, the leaves are obtuse at the base, while in those from Panama and Chepo they are acute. This latter character is the only one given by Dr. Pax to distinguish *S. moritzianum* from *S. aucuparium*, and the fact of its not being constant should decide the fate of the species. The capsules of the Peña Prieta tree seem to be larger and more depressed than in *S. aucuparium*; they are described, however, from specimens preserved in alcohol, and this may account for discrepancies. The detailed study of the flowers may yet bring to light really good distinctive characters, but, as the matter now stands, it must be confessed that there would be little reason to maintain *S. moritzianum* as a distinct species.

SAPINDACEAE.

A NEW SPECIES OF TALISIA FROM PANAMA.

Talisia panamensis Pittier, sp. nov.

A shrub, 1 to 3 meters high, the stem erect, unbranched.

Leaves glabrous, bunched at the ends of the stems, at first drooping and intensely pinkish, later spreading or ascending and green, the rachis subterete, 29 to 33 cm. long. Leaflets 5 or 7, coriaceous, subopposite or alternate, the petiolules more or less thickened, canaliculate, 0.5 to 1.5 cm. long, the blades oblong, cuneate at the base, abruptly acuminate at the apex, 12 to 21 cm. long, 4.5 to 6 cm. broad, dark green and lustrous above, the costa and veins impressed, beneath paler, conspicuously reticulate, the costa and veins very prominent.

Inflorescence cauline, racemose, loose, subpendulous, usually 3-fasciculate, the rachis angular, pubescent, 4 to 10 cm. long, sometimes branched at the base. Flowers 2 to 6 together on a short common peduncle, white, the pedicels about 1 mm. long. Calyx tubular, 4 to 5 mm. long, densely minute-pubescent without, 5-toothed. Petals 5, linear-cuneiform, obtuse, about 6 mm. long, glabrous, reflexed, bearing inside a hairy, bifid, erect, slightly longer appendage inserted above the claw. Disk cupulate, 1.5 mm. high, hairy. Stamens 8, glabrous, the filaments 4 mm. long, erect, the anthers introrse. Ovary 3-celled; stigma 3-lobulate, hairy, sessile.

Fruit not known.

Type in the U. S. National Herbarium, no. 716600, collected in the forests around Pinogana, southern Darién, Panama, in blossom, April 16, 1914, by H. Pittler (no. 6534).

This species belongs to the section *Eutalisia*, subsection *Acladodia* Radlk., characterized by having the petals markedly longer than the sepals, and the disk high and formed of 5 thick, connate scales, and by the large leaves. It seems to be closely related to *T. stricta* Triana & Planch., from which it differs by the glabrous leaves, petals, and stamens. *Talisia panamensis* grows scattered on small, lightly wooded hills in the forests of Darién, where it is easily detected on account of the peculiar appearance of its young leaves. It is the second representative of the genus reported from Panama, the first one, *T. nervosa* Radlk., having also been discovered by me, in 1911, on the Atlantic seaboard.

LECYTHIDACEAE.

A NEW SPECIES OF MONKEY-POT FROM COLOMBIA.

Lecythis curranii Pittler, sp. nov.

A tree, 30 meters high, the trunk 90 cm. in diameter at the base.

Leaves not known.

Inflorescence not known. Flowers pedicellate, about 4 cm. in diameter; pedicels 9 to 10 mm. long, thick, tomentellous. Calyx tomentellous, the sepals narrow-triangular, acute, 6 to 7 mm. long, entire. Petals 6, ovate or obovate, conchoid, rounded at the apex, 2 to 2.5 cm. long, 0.8 to 1.5 cm. broad, glabrous. Androphore ring about 1.5 cm. in diameter, the ligule 1.5 cm. long and broad, the galea ovate, broader than long. Filaments clavate; anthers ovate-globose. Ovary 4-celled, slightly convex above, the stigma almost sessile in the center.

Pyxidium ovoid, dark brown and smooth without, 17 cm. high (including operculum), the walls about 2.5 cm. thick, woody, the basal part 11.5 cm. high; calycary zone not very prominent, 6-lobed, 12.5 cm. in diameter; interzonal band 3.5 cm. high, 8 cm. in diameter at the apex on the margin of the operculum; operculum convex, slightly depressed at the center, 2 cm. thick. Seeds not known.

Type in the U. S. National Herbarium, no. 537552, collected on the trail from Norosí to Tiquisio, Department of Bolívar, Colombia, in flower and fruit, April-May, 1916, by H. M. Curran.

Miers reported and described from Colombia the following species:

Lecythis ampullaria Miers.

Lecythis bogotensis Miers.

Lecythis ampla Miers.

Lecythis elliptica H. B. K.

Lecythis dubia H. B. K.

Lecythis minor Jacq.

The first three we know only by their fruits, the descriptions of which do not agree with the above specimens; one of these species, *L. ampla*, has been found again by me in the forests of the San Blas Coast of Panama. Of the three latter species, which have small fruits, one, *L. elliptica*, is relatively well known and has been collected in recent years by H. H. Smith, H. M. Curran,

and myself, and the two remaining are evidently distinct from the large-fruited species here described.

A comparison with the species of the neighboring countries gave likewise negative results, so that the species may safely be considered new to science, and be named after Mr. Curran, its discoverer.

THEOPHRASTACEAE.

NEW SPECIES OF JACQUINIA AND CLAVIJA.

Jacquinia nemophila Pittier, sp. nov.

A shrub or small tree, about 3 meters high, sparsely branched, the branchlets more or less geniculate, the bark brownish or yellowish, glabrous and smooth.

Leaves opposite, sparse, glabrous; petioles canaliculate, 3 to 4 mm. long, dark-colored; blades oblong-elliptic, cuneately long-attenuate at the base, obtuse or subacute at the apex, 9 to 16 cm. long, 3 to 4.5 cm. broad, dark green above, the costa impressed, the venation prominulous (in the dry plant) and loosely reticulate, beneath paler, the costa prominent and the venation inconspicuous.

Inflorescence racemose, axillary or terminal, 2 to 5-flowered, 2 to 3 cm. long, the peduncle 3 to 5 mm. long, the pedicels minutely pubescent, 6 to 8 mm. long. Flowers subnutant. Sepals imbricate, suborbicular, about 4.5 mm. long and 5 mm. broad, sparsely ciliate. Corolla yellow, glabrous, the tube about 6 mm. long, the lobes suborbicular, about 6 mm. long and 8 mm. broad, reflexed. Staminalodes squamiform, 3 to 3.5 mm. long, 4 to 4.5 mm. broad, rounded, obtuse, irregularly sinuate on the margin. Stamens 4.5 to 5 mm. long, the anthers obovate, obtuse, apiculate, the cells acute and divaricate at the base. Ovary ovoid, glabrous, about 3 mm. long; style glabrous, about 1.3 mm. long, ending in a subcapitellate stigma.

Fruit globose, golden yellow, about 3 cm. in diameter; seeds ovoid or oblong, flattened, brownish, 11 to 13 mm. long, 9 to 10 mm. broad, 3 to 4 mm. thick.

Type in the U. S. National Herbarium, no. 679486, collected in the humid forests of the littoral plain of Sperdí, near Puerto Obaldía, San Blas Coast, Panama, in flower and fruit, September 3, 1911, by H. Pittier (no. 4342).

This species is quite distinct from *Jacquinia macrocarpa*, described by Cavanilles from the semiarid district of the Pacific coast of Panama. Its leaves are sparse, opposite, and not mucronate-spinescent; the flowers are large and rather pale yellow, etc. The two species have in common the relatively large fruits, in which the seeds are surrounded by a sweet pulp, formed by the dissepiments of the placentas. The habit of *J. nemophila* is striking for the genus on account of the long, sparse, and bare ramification, with geniculate, semipendent branchlets. Another peculiarity of this species is the fact that it is found in the rain forests of eastern Panama, while most of the species hitherto known are characteristic of arid or semiarid districts of tropical America.

In the key given by Mez in his elaboration of the Theophrastaceae¹ *J. nemophila* would come in group A, near *J. keyensis* and *J. revoluta*, but it differs from both in habit and in the shape of the anthers, corolla lobes, and staminalodes; from *J. keyensis* it is distinguished also by its large fruit, and from *J. revoluta* by its large, yellow flowers.

Clavija costaricana Pittier, sp. nov.

A shrub, 1 to 2 meters high, entirely glabrous.

Leaves large, coriaceous; petioles 2 to 4 cm. long, rather slender, subangular, blackish on the lower half (in the dry plant); blades obovate-elliptic, cuneately long-attenuate and subdecurrent at the base, more or less attenuate-acutate at the apex, 30 to 50 cm. long, 10 to 15 cm. broad, light green above, paler be-

¹ In Engl. Pflanzenreich IV. 236a: 29. 1903.

neath, the margin slightly revolute, entire; costa and venation prominulous above; costa and primary veins prominent beneath, the reticulation prominulous. Stipules linear, about 1 cm. long, turning black in drying.

Inflorescences (male) axillary, short (1 to 2 cm. long), the rachis glabrous. Bractlets inserted at the base of the pedicels, very small, triangular-acute, pilose-ciliate. Pedicels glabrous, 2 to 3 mm. long. Flowers tetramerous, orange-yellow. Calyx lobes membranous, ovate, obtuse, about 3 mm. long, minutely puberulous without. Corolla about 7 mm. long, the tube 2 mm. long, the lobes broadly ovate, rounded at the apex. Staminalodes distinct, ovate, fleshy, hardly longer than the corolla tube, the margin entire. Stamens 4, erect, free, the filaments very short, with a trigonous section. Style (in male flowers) rudimentary, plumose-hairy (?). Other details not known.

Type in the U. S. National Herbarium, no. 474411, collected in forests around Río Hondo, plains of Santa Clara, Costa Rica, at an altitude of about 100 meters, male flowers only, May 5, 1903, by O. F. Cook and C. B. Doyle (no. 551).

The only specimen at hand is not in very good condition, but is sufficient to show a marked difference from the three other species reported so far from Central America. From *C. biborrana* Örst. and *C. mezii* Pittier it departs in its much larger leaves, and from *C. lehmannii* Mez in the slender petioles and the larger, orange-yellow flowers. Some of the petioles are covered with large, crateriform glands, which would constitute an excellent distinctive character but that their presence on this specimen may be a mere accident.

Claviya costaricana grows in the rain forests of the Atlantic seaboard; the other Costa Rican species is from the less humid forests of Jarís and Monte Aguacate, on the Pacific slope.

***Claviya mezii* Pittier, sp. nov.**

A small, unramified shrub, 1 to 2 meters high. Younger parts of the stem thick, glabrous.

Leaves coriaceous, pale green, glabrous; petioles stout, 2.5 to 4 cm. long, angular, flattened on the upper side, thicker at the base; blades obovate-oblong, long-attenuate at the base, rounded and abruptly short-acuminate at the apex, 30 to 55 cm. long, 5 to 15 cm. broad, densely prominulous-reticulate; costa more or less flattened above, prominent on the lower face; primary veins prominulous, distinctly anastomosed along the thin, entire margin.

Male inflorescences loose, subnutant, 20 to 25-flowered, the rachis minutely pubescent, 10 to 12 cm. long; pedicels clavate, 2.5 to 3 mm. long, minutely puberulous, provided a little above the base with a very small, ovate-acuminate bractlet. Flowers small (not over 10 mm. in diameter), tetramerous, orange-red. Sepals suborbicular, about 2 mm. long and broad, glabrous, sinuate-fimbriate. Petals suborbicular or broadly ovate, concoid, about 4 mm. long and broad, entire, connate at the base in a very short tube. Staminalodes 4, glandlike, distinct, ovoid, alternating with the petals. Staminal tube slender, thickening toward the base, about 2 mm. long; anthers 8, connate in an obconical disk, this flat and 8-dentate on the upper face. Pistil rudimentary, lageniform. Female flowers not seen.

Fruit not known.

Type in the U. S. National Herbarium, no. 679440, collected in the hilly rain forest back of Puerto Obaldía, San Blas Coast, Panama, male flowers, August 30, 1911, by H. Pittier (no. 4313). Sterile specimens are mounted on sheet no. 679441.

The nearest affinities of this new species seem to be with *Claviya engelsii* Mez and *C. rodekiana* Mez. From the first it differs in having the flowers apparently all tetramerous and in the long petioles; from the latter in the smaller flowers and leaves, and the pubescent inflorescences.

THE NORTH AMERICAN SPECIES OF AQUILEGIA.

By EDWIN BLAKE PAYSON.

INTRODUCTION.

Doctor Gray once said: "Species are but judgments—judgments of variable value, and often very fallible judgments." No one who has ever studied plants in the field, in the garden, or in the herbarium will question the truth of this remark. Species are, indeed, judgments, and not only that, they are matters of convenience. It very often happens that species merge into one another almost imperceptibly, and for this reason it is often hard to decide how to classify an intermediate form. Yet the persistence of these intermediate forms furnishes no reason why the extremes should not be considered separate species. In order to speak accurately, and in order to make systematic botany of real value to science, distinctions must be critical and nice. The practice of grouping a mass of distinguishable and distinct things under a single name deserves no sympathy; but, on the other hand, the habit of giving a specific name to every slight variation is equally bad. The variability of the species is, of course, much more marked in some genera than in others. *Aquilegia* is a genus of the former class.

Different characters have different relative values for purposes of classification, and these characters differ in different genera; what would be considered specific in one group is no criterion in another. In *Aquilegia* characters which are of the utmost importance in many other genera are practically of no value. The leaflets, for instance, are extremely variable in size and shape and, except in a very general way, are of no diagnostic value. Whether the leaves are twice ternate or thrice ternate, on the other hand, seems to be a criterion of considerable value, although plants of species normally having triternate leaves may occasionally develop biternate leaves, and very occasionally those with biternate leaves may produce triternate ones. In a general way, certainly, this character is very useful. It will be in place, also, to notice in this connection that the species of the warmer, more arid regions are those having triternate leaves with rather small leaflets, while those of cool, moist regions are the ones with biternate leaves and large leaflets. Similarly, species of

arid regions are usually more pubescent than those of cool, moist habitats. Pubescence is extremely variable in the same species and except in a few cases of no moment whatever.

It is in the flower structures that the greatest and most constant differences are to be found. The relative length of the sepals, laminae, and spurs is very uniform for plants of the same species, as is also the position of the sepals, and it is on these characters that most of the present classification is based. Color is quite suggestive, although yellow forms of red flowers and white forms of blue flowers are not uncommon. Neither the stamens nor the pistils offer many differences, although the length of the style is at times a valuable character. The size of the follicles and their shape vary but little. That indefinable resultant of several characters—these mostly unimportant in themselves—described by the overworked word “aspect” is often a safe and sure guide to species, but it must necessarily be learned by each for himself, since it can not be stated except in suggestive terms. Finally, the range of a species must be regarded as a check of great importance. Plants differing by comparatively slight characters yet consistently separated in range must be considered distinct species, while plants exhibiting what seem to be no greater differences, yet having no distinct ranges, must be considered conspecific. Since hybridism is so easy and so prevalent, it is difficult to see how very closely related species could remain distinct when growing together. In this connection it must be remembered that in the western and particularly in the southwestern portions of this continent habitats vary immensely within a few miles, and that, although the ranges may seem to overlap on the map, the species commonly do not really intermingle, being separated by many hundred feet of altitude and living in very different surroundings.

The genus *Aquilegia* has for several years been of unusual interest to the author, and it is with great pleasure that, through the kindness of Prof. Aven Nelson, he has been able to bring to completion what he hopes will prove a conservative survey of the North American species. The work was done at the Rocky Mountain Herbarium under the direction of Professor Nelson, to whom the writer is greatly indebted for suggestions and constant encouragement and for making possible certain field work which has been of great advantage. To Mr. J. Francis Macbride, of the Gray Herbarium, the author wishes also to express his thanks for bibliographic assistance.

The success of any taxonomic work must depend largely upon the availability of adequate exsiccatae. In this matter the author feels himself particularly fortunate and wishes to acknowledge his indebtedness to the individuals and institutions who have so kindly lent material. He is under special obligation to the authorities of the

United States National Museum for the loan of the extensive collections of western United States and Mexican material in the National Herbarium, which, with the specimens in the Rocky Mountain Herbarium, the herbarium of the Missouri Botanical Garden, and the private collection of Mr. Marcus E. Jones, of Salt Lake City, have served as the main basis of the work. The material of the last mentioned collection was especially valuable on account of Mr. Jones's field knowledge of western *Aquilegias* and from the fact that his collections were made principally in regions where the particularly interesting forms occur. Other valuable collections studied were those of the Washington State College, Washington State Museum, Colorado State Agricultural College, and Nevada State Agricultural College, as well as that of Mr. George Osterhout, Windsor, Colo.

The accompanying illustrations were prepared by the author.

CHARACTERS OF GENUS AND SECTIONS.

AQUILEGIA L. COLUMBINE.

Stems usually several, terminating the branches of the thick caudex, erect, 10 to 120 cm. high (in *A. jonesii* almost entirely lacking); basal leaves tufted, biternate, triternate, or occasionally in some alpine species simply ternate; petioles generally long, dilated and sheathing at base; cauline leaves relatively few, diminishing in size and degree of complexity upward; involucral bracts often entire; leaflets obovate, cuneate, or suborbicular, 1 to 5 cm. long, irregularly 2 or 3-lobed, the lobes from entire to 5-cleft, usually rounded, glabrous or rarely pubescent, glaucous or glaucescent beneath; flowers nodding in the bud, erect or nodding in anthesis; sepals 5, attached to the torus by a short, narrow claw, the blades from narrowly lanceolate and acuminate to broadly oblong and obtuse; petals¹ composed of two parts, the *lamina*, an expanded petal-like structure alternating with the sepals, and the *spur*, a hollow prolongation of the base of the lamina bearing at its apex the nectar-secreting gland; laminae from spatulate and well developed to almost entirely obsolete; spurs short and hooked to long and straight; stamens numerous, 2.5 cm. long or less, in most cases exceeding the sepals; anthers yellow, about 1 mm. long, adnate; ovaries usually 5, surrounded by a sheath of membranous, flattened staminodia, erect, usually pubescent and glandular; styles filiform, 3 to 18 mm. long; fruits erect, follicular, the suture being on the inner side, 1 to 2 cm. long, the tips more or less spreading.

In a consideration of the internal relationships and the development of *Aquilegia* the question presents itself, what should be considered primitive and less specialized and what recent and more specialized characters. The characters we have to concern ourselves about here relate to:

1. *The stem.* The few-flowered stem of medium height with few branches is considered the most primitive stem of modern species, and the low, single-flowered stem of certain alpine species as well as the very tall, much-branched, many-flowered stems of some southern representatives are held to be derived forms.

¹ This name is retained for these structures for convenience only, since it seems probable that they are greatly modified nectar-secreting staminodia instead of true perianth segments. For a complete discussion of this point see Prantl, in Engl. & Prantl, *Pflanzenfam.* 3²: 49. 1888.

2. *The leaf.* The biternate leaf is regarded as representing the form from which the triternate leaves of southern species as well as the simply ternate ones of a few alpine species have been evolved.

3. *The presence or absence of indument.* When quite universally present, pubescence undoubtedly shows specialization.

4. *The petals.* Since we must consider these organs to be greatly modified staminiodia, developed from structures similar to the large petal-like organs of some species of *Isopyrum* and *Clematis* which bear at their bases a small depression in which nectar is secreted, it is evident that the large, well-developed laminae as well as the short spurs are more primitive than the short or obsolete laminae and long spurs.

5. *The posture of the flowers.* The nodding condition of the flower seems to be more primitive, for the modern species at least, than the erect position, since the flowers of otherwise more primitive plants are nodding while the flowers of otherwise more specialized forms are erect. It is also suggestive that the nodding condition is universal in the bud.

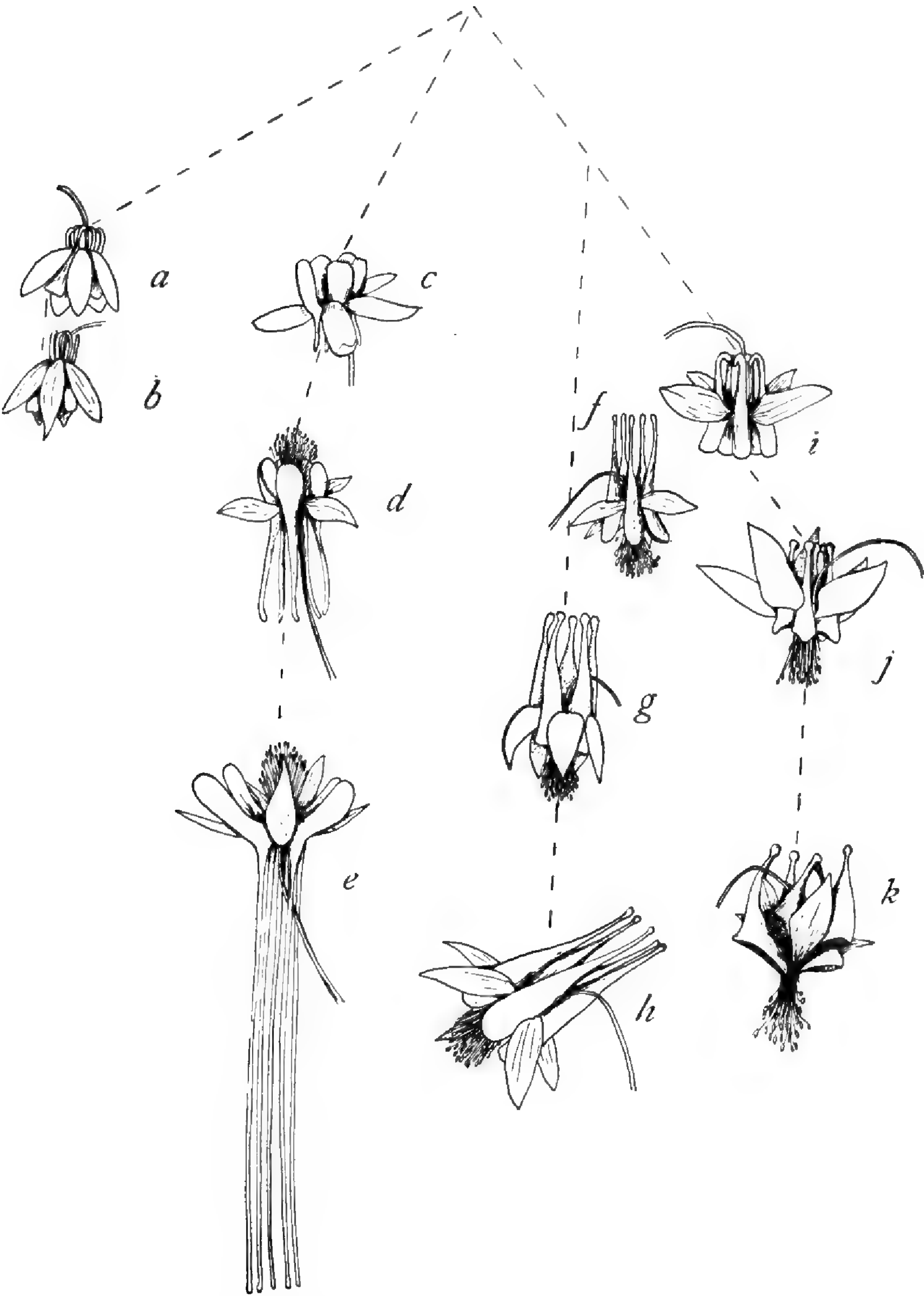
6. *The color of the flowers.* The modern species of *Aquilegia* seem to have been developed from species having blue flowers. These seem first to have given rise to white-flowered, these to yellow-flowered, and these finally to red-flowered species.

7. *The habitat.* *Aquilegia* evidently was originally a genus of cooler habitats, and an advance into warmer regions is in itself an indication of specialization, inasmuch as the less specialized forms structurally are those that live in cool regions and the more specialized structurally those that live in the more arid, hotter habitats. An advance into arctic conditions (on mountain tops) is also an evidence of specializing adaptation.

The species of *Aquilegia* group themselves into three quite distinct sections, which I have termed *Cyrtoplectrae*, *Rhodanthae*, and *Macropectrae*. The first is characterized by biternate leaves, small, blue or white, nodding flowers, large, dilated laminae, short, usually hooked spurs, mostly included stamens, and short styles. The second by biternate or triternate leaves, larger, occasionally yellow but usually red, nodding flowers, short or nearly obsolete laminae (except in *A. flavescens*), rather long, stout, and mostly straight spurs, exserted stamens, and long styles. The third section, *Macropectrae*, possesses biternate or triternate leaves, large, erect, blue, white, or yellow flowers, large and dilated laminae, very long, slender, straight spurs, exserted stamens, and styles of medium length.

Cyrtoplectrae is the section least conspicuous in America, being represented (so far as now known) by only three native species, these local at high altitudes in the Rocky Mountains from Colorado into Canada. If we are to assume that the genus had its genesis in America, as seems likely, we must consider this section to be the oldest of the three, since it alone has spread through the temperate portions of the northern hemisphere. It also contains more primitive characters than do the other sections, and so may be thought of as representing more nearly the ancestral type of *Aquilegia*.

There are in the section *Rhodanthae* two fairly distinct lines of development, one group characterized by *A. formosa* of the Pacific coast and the other by *A. canadensis* of the eastern United States and Canada. The first contains the species *formosa*, *flavescens*, *tracyi*, etc., and is characterized by the rather short spurs, the short or almost obsolete laminae, and the large, horizontally spreading or reflexed sepals which often equal or exceed the spurs in length. This group is connected somewhat with the section *Cyrtoplectrae* by the species *flavescens* which has small, yellow flowers, short and often hooked spurs, and well-developed laminae. In the second group we find the most highly developed flowers of the section in the species *A. skinneri* of Mexico. In this plant the blossoms resemble superficially those of the section *Macropectrae* and, judging from the length of the spurs and the lighter color of the flower, are pollinated differently from those of most other species of this section, i. e., by moths instead of humming birds.



PHYLOGENETIC CHART OF NORTH AMERICAN AQUILEGIA.

The section *Macroplectrae* is confined to the Rocky Mountains of the United States and northern Mexico and contains such well-known ornamental plants as *A. caerulea* and *A. chrysantha*. In it we find an interesting mingling of what have been considered primitive as well as those thought of as modern characters. The erect flowers and the very long spurs are modern adaptations, while the large laminæ and the more primitive colors (blue, white, or yellow) are characters persisting from ancestral types. It is not difficult to see why the color has remained light, since these plants are mostly pollinated by moths. The large laminæ serve to make the flower more conspicuous, and it is for this reason undoubtedly that they have been retained. It seems that this section must be considered the most specialized and modern of the three and *A. longissima* the most highly developed of all the species of the genus.

Hybridism is of common occurrence in this genus. Wherever two species are found growing together we may expect to find hybrids, even though the species belong to different sections. Mr. M. E. Jones has noticed and collected many hybrids between *A. caerulea* and *A. flavescens* where the species were growing together at Alta, Utah. *A. caerulea alpina* may be the result of such a cross, since the locality in which it was found is in a region where the ranges of *A. caerulea* and *A. flavescens* join. Probably it is because *Aquilegiae* are so variable and hybridize so readily that no two closely related species seem ever to grow together. For this reason, also, isolation may be thought of as being the chief factor in species production in this genus.

The accompanying chart (pl. 8) represents the hypothetical course of development of the species of *Aquilegia*. The flowers are shown at about one-half natural size. It will be noticed that the succession of the figures downwards on the page represents in each group a progressive development in color and structure. At the same time the upper figures in every case are of more northern species than the lower, or else of alpine ones; that is, extension southward or to lower altitudes is coordinate with specialization in color and form.

DESCRIPTIONS OF SPECIES WITH KEY.

KEY TO THE SPECIES.

Flowers nodding.

Flowers blue or white; spurs hooked, less than 1.5 cm. long; laminæ as long as the stamens. (CYRTOPECTRAE.)

Flowers blue and white.

Stems 30 cm. tall or more.

Flowers about 2 cm. long; native species..1. *A. brevistyla*.

Flowers about 3.5 cm. long; introduced species..2. *A. vulgaris*.

Stems 8 to 15 cm. tall, glabrous.....3. *A. saximontana*.

Flowers white. Plants more or less pubescent.....4. *A. laramiensis*.

EXPLANATION OF PLATE 8.—Figs. *a* and *b*, representatives of the section *Cyrtoplectrae* in America. *a*, *Aquilegia saximontana*, flowers blue, alt. 3,000 to 3,600 meters, Colorado; *b*, *A. laramiensis*, flowers white, alt. 2,100 meters, southern Wyoming.

Figs. *c*, *d*, and *e*, representatives of the section *Macroplectrae*. *c*, *A. jonesii*, flowers blue, alpine, Montana; *d*, *A. pallens*, flowers white, alt. 1,500 meters, Colorado; *e*, *A. longissima*, flowers yellow, mountains in northern Mexico.

Figs. *f*, *g*, and *h*, representatives of the *canadensis* group of the *Rhodanthae*; *f*, *A. lithophila*, flowers yellow, eastern Utah; *g*, *A. triternata*, flowers red, Arizona; *h*, *A. skinneri*, flowers light red and greenish, Mexico.

Figs. *i*, *j*, and *k*, representatives of the *formosa* group of the *Rhodanthae*. *i*, *A. flavescens*, flowers yellow, higher altitudes, Montana; *j*, *A. formosa*, flowers red, low altitudes, from Oregon to Alaska; *k*, *A. tracyi*, flowers red, California.

- Flowers red or yellow; spurs nearly straight, 2 to 5 cm. long; stamens longer than laminae. (RHODANTHAE.)
- Sepals horizontally spreading or reflexed, usually equaling or exceeding the spurs.
- Flowers yellow, the sepals occasionally pink....5. *A. flavescens*.
- Flowers red or pink.
- Base of spur truncate or one side produced into a more or less distinct lamina.
- Spurs about 2 cm. long; leaves usually biternate.
- Leaves membranous; sepals light red...8. *A. wawawensis*.
- Leaves thick; sepals dark red.....6. *A. formosa*.
- Spurs about 3 cm. long, slender; leaves triternate.
7. *A. shockleyi*.
- Base of spur cut backwards, the laminae obsolete. Leaves triternate9. *A. tracyi*.
- Sepals slightly spreading or erect, shorter than the spurs.
- Spurs (as also the laminae) yellow; leaflets viscid...10. *A. lithophila*.
- Spurs red; leaflets various.
- Basal leaves biternate rather than triternate.
- Flowers large, the sepals about three-fourths as long as the spurs; eastern species.....11. *A. canadensis*.
- Flowers small, the sepals about one-half as long as the spurs; western species.
- Leaflets not viscid, suborbicular.
- Leaflets green above; sepals light red.
15. *A. elegantula*.
- Leaflets glaucous on both surfaces; sepals dark red.
13. *A. desertorum*.
- Leaflets viscid, narrow.....14. *A. rubicunda*.
- Basal leaves distinctly triternate. Southern species.
- Spurs about 3 cm. long; sepals red12. *A. triternata*.
- Spurs 4 to 5 cm. long; sepals greenish.....16. *A. skinneri*.
- Flowers erect. Spurs slender, straight, usually more than 3.5 cm. long, never red. (MACROPLECTRAE.)
- Spurs not over 8 cm. long.
- Basal leaves once or twice ternate.
- Sepals blue or white.
- Leaflets normal.
- Spurs 5 cm. long or more; leaflets not viscid...18. *A. caerulea*.
- Spurs about 3 cm. long; leaflets viscid beneath.
20. *A. pallens*.
- Leaflets thick, small, closely clustered.
- Spurs about 1 cm. long; stems scapose.....17. *A. jonesii*.
- Spurs about 4 cm. long; stems bracteate...21. *A. scopulorum*.
- Sepals yellow.
- Leaflets small, glabrous throughout. Native of southern New Mexico.....24. *A. chaplinei*.
- Leaflets medium-sized, glabrate to densely pubescent beneath.
- Alpine in the Sierra Nevada of California...22. *A. pubescens*.
- Basal leaves, or some of them, triternate.
- Spurs not more than 2 cm. long or wanting19. *A. ecalcarata*.
- Spurs 4 to 7 cm. long. Flowers yellow.
- Sepals and petals subequal.....24. *A. chaplinei*.
- Sepals exceeding the petals.....23. *A. chrysantha*.
- Spurs 10 cm. long or more.....25. *A. longissima*.

1. *Aquilegia brevistyla* Hook. Fl. Bor. Amer. 1: 24. 1829.

Aquilegia vulgaris L. err. det. Richards. Bot. App. Frankl. Journ. 740. 1823.

Aquilegia vulgaris brevistyla A. Gray, Amer. Journ. Sci. II. 33: 243. 1862.

Stems 40 to 80 cm. high, simple, glabrate or puberulent below, pubescent and often glandular above; basal leaves biternate, the leaflets petioluled, medium to large (17 to 40 mm. long, 27 to 52 mm. wide), pubescent and glaucous beneath, the uppermost leaves simple and entire; flower 1.5 to 2 cm. long, 2.5 to 3 cm. across, nodding; sepals blue, lanceolate, acute, slightly spreading, 13 to 16 mm. long, exceeding the laminae by 2 to 4 mm., these and the sepals exceeding the stamens; laminae yellowish white, longer than the spurs, oblong, more or less truncate at apex; spurs blue, 6 to 7 mm. long, stout and strongly hooked; styles 5 to 7 mm. long; ovaries pubescent; follicles about 2 cm. long.

TYPE LOCALITY: Western Canada.

RANGE: South Dakota and Alberta, north to the Yukon.

REFERENCES: Torr. & Gray, Fl. N. Amer. 1: 30. 1838. Robinson, Syn. Fl. 1: 43. 1895. Rydb. Contr. U. S. Nat. Herb. 3: 482. 1896. Davis, Minn. Bot. Stud. 2: 334. 1899. Britt. & Brown, Illustr. Fl. ed. 2. 2: 93. 1913.

SPECIMENS EXAMINED.

YUKON: Five Finger Rapids, Tarleton 91b. Mill Flat, Gorman 1049.

NORTHWEST TERRITORY: Fort Good Hope, Mackenzie River, Taylor.

ALBERTA: Banff, McCalla 2107. Calgary, Macoun 18069.

SOUTH DAKOTA: Piedmont and Little Elk Creek, Rydberg 503.

Aquilegia brevistyla belongs to the Old World type of columbines, and has much the aspect of *A. vulgaris*. Its range, like those of *A. saximontana* and *A. laramiensis*, is peculiar in that it is widely separated from those of its relatives. These species seem to have become stranded, as it were, away from their fellows. Once, perhaps, this type was common throughout North America, but, if so, it has been superseded by the two more recent groups.

2. *Aquilegia vulgaris* L. Sp. Pl. 533. 1753.

Stems stout, finely pubescent throughout, 30 to 70 cm. high; basal and lower cauline leaves biternate; flowers 3.5 to 5 cm. broad and about as long, nodding, blue or purple to white; sepals spreading, ovate, acute, about 2.5 cm. long; laminae as long as the spurs, equaling the head of stamens, shorter than the sepals; spurs stout, much incurved, 10 to 13 mm. long; ovaries pubescent; styles 1.3 cm. long; follicles 2.5 cm. long, densely pubescent.

It is this species that is seen most often in cultivation. The flowers in the horticultural varieties vary greatly in color and are often exceedingly double as a result of the multiplication of spurs or, in the stellate ones, of the assumption by most of the flower structures of the form of plane sepals. A native of Europe and Siberia, occasionally escaping from cultivation, especially in the Eastern States.

3. *Aquilegia saximontana* Rydb.; Robinson, Syn. Fl. 1: 43. 1895.

Aquilegia vulgaris brevistyla A. Gray, Amer. Journ. Sci. II. 33: 242. 1862, excluding synonyms.

Aquilegia brevistyla Hook. err. det. Coulter, Man. Rocky Mount. 10. 1885.

Smooth and glabrous throughout; stems densely tufted, scarcely exceeding the leaves, 8 to 15 cm. high; basal leaves biternate, the cauline few (mostly reduced to bracts), the similar or simply ternate leaflets small (12 to 16 mm. long), sessile, thickish, broadly cuneate or truncate at base, the lobes rounded; flowers 1.5 to 2 cm. long and about as wide, nodding; sepals blue, ovate-oblong, obtuse or acute; laminae white "or yellowish" (?), about 8 mm. long, obtuse; spurs blue, incurved or strongly hooked, about 6 mm. long; styles 3 to 4 mm. long; ovaries glabrous; follicles 5 or 6, 1 cm. long, the tips slightly spreading.

TYPE LOCALITY: Rocky Mountains of Colorado.

RANGE: Alpine or subalpine on the mountains of north central Colorado as far south as Pikes Peak.

REFERENCES: Rydb. Contr. U. S. Nat. Herb. 3: 482. 1896, a valuable article, giving figures of *A. brevistyla* and *A. saximontana*, and discussing the relationships of the species of this group. Rydb. Colo. Agr. Exp. Sta. Bull. 100: 136. 1906. A. Nels. in Coulter, New Man. Rocky Mount. 192. 1909.

SPECIMENS EXAMINED.

COLORADO: West of Cameron Pass, Larimer County, *Crandall* 1885. Flat Top, Estes Park, *Osterhout* 789. Bottomless Pit, near Pikes Peak, *Clements* 511, 528. Mountains of Estes Park, *Osterhout* 2827, 3121, *Johnston* 369. Twin Sister Mountain, Estes Park, *Cooper* 7. Argentine Pass, *Jones* 875. Foot of Grays Peak, *Shear* 4632. Near Georgetown, *Marsh*. Mount Princeton, *Sheldon* 331.

A rare species, allied to *A. laramiensis* A. Nels. and *A. brevistyla* Hook., but apparently intergrading with neither. Unique in the genus because of its total lack of pubescence.

4. *Aquilegia laramiensis* A. Nels. First Rep. Fl. Wyo. 18. 1896.

Stems many from a rather large root, 10 to 20 cm. high, more or less decumbent and diffuse, sparingly pubescent; basal and larger stem leaves biternate, the leaflets short-petioluled, broadly obovate, large (for this group), 20 to 28 mm. long, thin, glaucous and sparingly pubescent beneath, the lobes obtuse and rounded, none of the leaflets simple; flowers 1.5 to 2 cm. long and about as wide, exceeded by the leaves, nodding; sepals greenish white, lanceolate, acute, 10 to 15 mm. long, exceeding the laminae by 1 to 3 mm., slightly spreading; laminae cream-colored, oblong, obtuse, 10 to 12 mm. long; spurs white, incurved or hooked, 5 to 7 mm. long; styles about 5 mm. long; ovaries pubescent; follicles 5, 1 to 1.2 cm. long, the tips slightly spreading.

TYPE LOCALITY: Cottonwood Canyon, Albany County, Wyoming.

RANGE: Albany County, Wyoming.

REFERENCE: A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909.

SPECIMENS EXAMINED.

WYOMING: Cottonwood Canyon, *Nelson* 1581 (type). Ragged Top, *Nelson* 8232. Antelope Basin, *Nelson* 7505.

An apparently distinct and most interesting species, collected by Dr. Nelson in practically but one locality in Albany County, Wyoming, where it grows in rock crevices or beneath overhanging ledges at an altitude of less than 2,100 meters. It is to be distinguished from *A. saximontana*, to which it is closely allied, by its longer, more diffuse stems, its much larger, thinner leaflets with scanty pubescence, and its white flowers and longer styles.

5. *Aquilegia flavescens* S. Wats. in King, Geol. Expl. 40th Par. 5: 10. 1871.

Aquilegia canadensis aurea Roetzl; Regel, Gartenflora 21: 258. pl. 734. 1872.

Aquilegia caerulea flavescens Lawson, Proc. & Trans. Roy. Soc. Canada 24: 76. 1885.

Aquilegia depauperata Jones, Contr. West. Bot. 8: 1. 1898.

Aquilegia caerulea flavescens Jones, Contr. West. Bot. 8: 2. 1898.

Aquilegia canadensis flavescens Davis, Minn. Bot. Stud. 2: 335. 1899.

Aquilegia formosa flavescens Frye & Rigg, Northw. Fl. 165. 1912.

Stems 30 to 60 cm. high, usually pubescent; basal leaves biternate, the leaflets rather large, glabrate or finely pubescent, glaucous beneath; flower 3 to 3.5 cm. long, 3.5 to 4 cm. across, nodding, yellow throughout; sepals occasionally tinged with red, ovate-oblong, spreading or reflexed, 20 to 25 mm. long, exceeding the laminae about 10 mm.; laminae broadly rounded, 7 to 9 mm. long; spurs stout and usually more or

less hooked at apex, 15 to 18 mm. long; styles 9 to 10 mm. long; ovaries finely pubescent; follicles 4 to 6, 1.5 to 2 cm. long, the tips usually erect.

TYPE LOCALITY: Wasatch Mountains, Utah.

RANGE: From the Canadian Rocky Mountains south through western Montana and adjacent Wyoming to northern Utah, westward to eastern Oregon and Washington.

REFERENCES: A. Gray, Amer. Journ. Sci. III. 3: 149. 1872. Baker, Gard. Chron. n. ser. 10: 20. 1878. Jones, Zoe 4: 257. 1893. Robinson, Syn. Fl. 1: 43. 1895. A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909. Jones, Bull. Univ. Mont. 61: 28. 1910. Tidestrom, Amer. Mid. Nat. 1: 171. 1910.

SPECIMENS EXAMINED.

CANADA: Selkirk and Rocky Mountains, British Columbia, *Shaw* 282. Selkirk and Rocky Mountains, *Peterson* 23. Selkirk Mountains, headwaters of Downie Creek, *Shaw* 1141. Vicinity of Banff, Alberta, *McCalla* 2108. Head of Smoky River, Alberta, *Hollister* 10. Lake Louise, *Macoun* 64289, *Taylor*. Sophie Mountain, British Columbia, *Macoun* 63471. Lime Dike, British Columbia, *Scheuber*. South Fork of Moose River, British Columbia, *Riley* 52.

MONTANA: Mystic Lake, *Blankinship* 5. MacDougal Peak, near Flathead Lake, *Clemens*, *Jones* 7983. Spanish Basin, Madison Range, *Flodman* 453. Lambert Valley, Mission Mountains, *Jones*. Gallatin Mountains, *Jones*. Mount Haggin, near Anaconda, *Jones*. Mineral Park, Glacier National Park, *Jones*. Avalanche Lake, Glacier National Park, *Jones*. Mount Bridger, Gallatin Valley, *Jones*. Mountains east of Tobacco Plains, *H. B. Ayres*. Near Red Lodge, *Rose* 105. Near Bozeman, *Canby* 14. Columbia Falls, *Williams* 685. Bridger Mountains, *Rydberg & Bessey* 4067. Jack Creek Canyon, *Rydberg & Bessey* 4070. Midvale, *Umbach* 189. Bracket Creek, *W. W. Jones*. Glacier Basin, *Vreeland* 1056. Lake McDonald, *Vreeland* 907.

YELLOWSTONE NATIONAL PARK: Undine Falls, *A. & E. Nelson* 5685. "North-western Wyoming," *Parry* 2. Yellowstone Falls, *Broadhead*. Near Mammoth Hot Springs, *Burglehaus* 34. Amethyst Mountain, *Knowlton*. Yellowstone Lake, *Adams*. Swan Lake Valley, *Knowlton*. Aldridge, *Scheuber*. Tower Falls, *Mearns* 3578. Electric Peak, *Mearns* 127.

WYOMING: Teton Mountains, *Merrill & Wilcox* 1064.

UTAH: City Creek Canyon, near Salt Lake City, *Clemens*; *G. Engelmann*; *Jones*. Black Mountain, Manti, *Jones*. Logan Canyon, Divide, *Mulford* 203. Alta, *Jones*. Provo Canyon, *Jones* (type of *A. depauperata* Jones). Silver Lake, American Fork Canyon, *Jones*. Marysvale, *Jones*. Deer Creek, Wasatch Mountains, *Jones* (sepals pink). Wasatch Mountains, *Watson* 36, 35. Ephraim Canyon, *Tidestrom* 321. Big Cottonwood Canyon, *Rydberg* 6739.

IDAHO: Cuddy Mountains, *Jones* 6128. Packsaddle Peak, near Lake Pend d'Oreille, *Sandberg*, *MacDougal & Heller* 840. Payette Lake, *Jones*. Seven Devil Mountains, *Jones*. Lolo Trail, *Watson* 20. Near source of Mill Creek, above Lemhi Indian Reservation, *Henderson* 4023. Slopes of Stevens Peak, *Leiberg* 1458. Bonanza, *Macbride & Payson* 3488.

WASHINGTON: Wenatchee Mountains, *Elmer* 446. Near top of Mount Baldy.

OREGON: Wallowa Mountains, *Cusick* 2450. North of Bald Knob, *Sampson & Pearson* 102.

Aquilegia flavescens is certainly most closely related to *A. formosa* Fisch. and may, I believe, be considered the parent of that species. The greatest development of *flavescens* occurs in the higher mountains of Montana and adjacent Wyoming and Canada. As we go westward from this region we find the species apparently merging into *formosa*; the sepals become salmon-colored or pink, the laminae shorter, and the spurs straight. This transitional area is often characterized by the lack of typical plants of either species, and in the mountains of Custer County, Idaho, the author

has seen great patches of a variety with beautiful salmon-colored flowers entirely replacing the red *formosa* and the yellow *flavescens*. Since in the centers of their ranges *formosa* and *flavescens* are amply distinct, the author is very loath to treat one plant as a subspecies of the other. It would seem best to retain each as a species, never forgetting, however, that in certain regions the two actually merge.

AQUILEGIA FLAVESCENS forma *MINOR* Tidestrom, Amer. Mid. Nat. 1: 171. 1910.

"Subalpine, smaller and more hairy. Wasatch Plateau." (Tidestrom.)

6. *Aquilegia formosa* Fisch.; DC. Prodr. 1: 50. 1824.

Aquilegia canadensis Hook. Fl. Bor. Amer. 1: 24 (in part). 1829.

Aquilegia arctica Loud. Hort. Brit. 610. 1830.

Aquilegia canadensis L. err. det. Bong. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 2: 124. 1832.

Aquilegia canadensis formosa S. Wats. in King, Geol. Expl. 40th Par. 5: 10. 1871.

Aquilegia columbiana Rydb. Bull. Torrey Club 29: 145. 1902.

Stems 35 to 90 cm. high, usually glabrous below, more or less pubescent and viscid in the inflorescence; lower leaves biternate, the upper ones simple or 3-cleft, the petioles and lower surfaces of the typically large leaflets frequently pubescent; flowers 3.5 to 4 cm. long, 5 to 5.5 cm. across, nodding; sepals red, ovate-lanceolate, acute, widely spreading or reflexed, 21 to 26 mm. long; laminae yellow, rounded or truncate at apex, 2 to 5 mm. long; spurs red, stout, straight, slightly shorter than sepals; styles 10 to 13 mm. long; ovaries pubescent; follicles mostly 5, 2 to 2.5 cm. long.

TYPE LOCALITY: Kamchatka.

RANGE: Nevada and northern California, eastward to Utah and northward into Alaska; also in eastern Siberia.

REFERENCES: S. Wats. in King, Geol. Expl. 40th Par. 5: 10. 1871. Jones, Contr. West. Bot. 5: 259. 1893. Robinson, Syn. Fl. 1: 44. 1895. Davis, Minn. Bot. Stud. 2: 340. 1899. Tidestrom, Amer. Mid. Nat. 1: 169. 1910. Jepson, Fl. Calif. 518. 1914.

SPECIMENS EXAMINED (localities only).

ALASKA: Taku Inlet; Wrangell; Juneau; Windham Bay; Disenchantment Bay; Sitka; Short Bay; headwaters of Chilkat River; Blue Lake, Sitka; Cleveland Peninsula; Howkan; Haenke Island, Disenchantment Bay.

CANADA: Vancouver Island; Queen Charlottes Island, British Columbia; Selkirk and Rocky Mountains, Asulkan Valley, British Columbia; head of Smoky River, Alberta; Moresby Island, British Columbia.

WASHINGTON: Wilbur; Ellensburg, Okanogan County; Loomiston; near Wenatchee; Silverton; Mount Rainier Forest Reserve; Blue Mountains; Walla Walla County; Cascade Mountains; Yakima Region; Grand Coulee; Douglas County; Egbert Springs; Ellensburg; Olympic Mountains; Falcon Valley; Horseshoe Basin; near Egbert Spring; Douglas County; mountains near upper valley of the Nesqually; Montesano, Chehalis County; Mount Stewart.

OREGON: Portland; Jackson County; Elk Mountain, Wallowa County; Mount Hood; Steins Mountain; Crater Lake; Crook County; The Dalles; near Wimer, Jackson County; Quinn Meadows, Lane County; Buck Lake, Klamath County; Azaba Creek; Wallowa National Forest; Imnaha National Forest; near Wallowa.

IDAHO: Boise; Silver City; Trinity Lake Region; Twilight Gulch; Martin, Blaine County; 4 miles south of Ketchum; Pettit Lake Inlet; between St. Joe and Clearwater River (form near *flavescens*); Big Butte Station.

CALIFORNIA: Near Truckee; Crystal Springs Lake, San Mateo County; Tassajara Hot Springs, Monterey County; below Genesee, Plumas County; Goosenest, Siskiyou County; Pit River Ferry, Shasta County; Sopago, Eldorado County; Round Valley, Mendocino County; Mount Hood, Sonoma County; Stevens Creek Canyon, Santa Clara County; Modoc County; Mount Breckinridge, Kern County; Emigrant Gap.

NEVADA: Centerville; near Blaine post office, Elko County; Hunter Creek Canyon, Washoe County; Kings Canyon, Ormsby County; Little Lakes Canyon, Elko County; Calientes; Ely; vicinity of Reno; west of Franktown; Star Canyon, southeast of Deeth; Unionville; East Humbolt Mountains; Hawthorne, Big Indian Canyon; Star Peak; Cumberland; Lake Tahoe.

UTAH: Mount Ibapah; Hillman Ranch, Juab County; Aqui Mountains; "southern Utah."

Aquilegia formosa is the representative of the Rhodanthæ most widely distributed in the northwestern part of North America. In the northern part of its range it is a quite uniform and homogeneous species, but in the southern and more arid regions of California, Nevada, and Utah it breaks up into an endless number of forms and subspecies. Some of these forms have been thought sufficiently peculiar to deserve specific names, such as *A. tracyi*, *A. shockleyi*, and *A. wawawensis*. Other plants, differing from *formosa* in several ways, but showing more points of intergradation with that species, have been treated as subspecies. *Aquilegia columbiana* Rydb. has been reduced to *A. formosa* rather than the subspecies *truncata*, which it in fact most closely resembles. This was done because it was not believed to be genetically related to the subspecies *truncata*. It is a rather similar form which has arisen separately. Unlike *truncata* it does not become the dominant form in any region, but is found with typical *formosa*.

The present species is a plant of a lower altitude than *A. flavescens*. In the few regions where the two grow near together the typical *A. flavescens* will be found on the higher areas and *A. formosa* in the river bottoms. This was noticed by the author in Custer County, Idaho. There, near the town of Challis, at an altitude of 1,620 meters, was found nearly typical *formosa*, while on the slopes of Parker Mountain, about 25 miles away and at an altitude of 2,400 to 2,700 meters, was found nearly typical *flavescens*. Intermediate forms were met along Challis Creek between these altitudes.

The following key will aid in separating the type and the subspecies:

Leaves biternate.

Laminæ over 1 mm. long.

Plants tall and branching.....6. *A. formosa*.

Plants subacaulescent and tufted.....6b. *A. formosa pauciflora*.

Laminæ less than 1 mm. long. Plant of California..6a. *A. formosa truncata*.

Leaves triternate.

Leaflets narrow; spurs thick.....6c. *A. formosa dissecta*.

Leaflets suborbicular; spurs slender.....6d. *A. formosa caelifax*.

6a. *Aquilegia formosa truncata* (Fisch. & Mey.) Jones, Zoe 4: 259. 1893.

Aquilegia truncata Fisch. & Mey. Ind. Sem. Hort. Petrop. 9: Suppl. 8. 1843.

Aquilegia californica Lindl. Gard. Chron. 1854: 836. 1854.

Aquilegia eximia Van Houtte; Planch. Fl. Serr. Jard. II. 2: 15. 1857.

Aquilegia canadensis formosa Torr.; S. Wats. in King, Geol. Expl. 40th Par. 5: 10. 1871.

Aquilegia hypolasia Greene, Leaflets 2: 141. 1911.

Aquilegia adiantoides Greene, Leaflets 2: 142. 1911.

Although long kept as a distinct species, this subspecies seems to differ from *A. formosa* only by the very short laminæ (1 mm. long or less). While replacing the species in southern California it is also found with it throughout the southern part of its range. Everywhere occur many intermediate forms that make determination difficult.

TYPE LOCALITY: Fort Ross.

REFERENCES: Robinson, Syn. Fl. 1: 44. 1895. Merritt, Erythea 4: 102. 1896. Jepson, Fl. Calif. 517. 1914.

SPECIMENS EXAMINED (localities only).

CALIFORNIA: Butte County; Pacific Grove; San Bernardino Mountains; San Bernardino County; San Antonio Mountains; Santa Clara County; San Jacinto Mountains; San Diego; "on San Carlos"; Mount Shasta; Bodega Bay, Sonoma County; Yosemite; Redding; San Antonio Canyon near Claremont; near Pit River Ferry, Shasta County; Coiby, Butte County; Sopago, Eldorado County; Chico Meadows, Butte County; Crystal Springs, San Mateo County; Big Meadows, Lassen County; Webber Lake; Los Gatos, Santa Clara County; Los Angeles; San Mateo County; Monterey; Inyo Mountains, Inyo County; valley of Kaweah River, Sierra Nevada; Santa Lucia Mountains; Green Horn Mountains; Kern County; Emigrant Gap; Silver Creek; Bolinas Ridge, Marin County; Mount Hamilton; southeast of Monte Diablo; Sherwood Valley; Obsolescent Valley, San Francisco Valley; Humboldt County; Half Moon Lake; Swartout Canyon, San Gabriel Mountains; San Bruno Mountains, San Mateo County.

OREGON: Willamette Hills; near Ashland, Jackson County.

IDAHO: Florida Mountain.

NEVADA: Galena Creek, Washoe County.

6b. *Aquilegia formosa pauciflora* (Greene).

Aquilegia pauciflora Greene, Leaflets 1: 76. 1904.

Aquilegia truncata pauciflora Jepson, Fl. Calif. 517. 1914.

A subacaulescent plant and more compact than the species; leaves mostly basal and tufted; flowers few; blade of petal distinct but short.

TYPE LOCALITY: Hacketts Meadows, Tulare County, California.

RANGE: "High montane in the Sierra Nevada, observed in its extreme form at Conness Creek and elsewhere in the Yosemite Park" (Jepson).

6c. *Aquilegia formosa dissecta* subsp. nov.

Stems 60 to 80 cm. high, glabrous, branching and many-flowered; basal leaves on long petioles, distinctly triternate; leaflets narrow, deeply cleft, glabrous; flowers pale red or yellow; sepals spreading; laminae 6 to 7 mm. long; spurs rather stout, straight, exceeding the sepals.

Type in the U. S. National Herbarium, no. 855674, collected at Mile 16, Meadow Valley Wash, Nevada, April 28, 1904, by M. E. Jones.

RANGE: Known only from the type locality.

6d. *Aquilegia formosa caelifax* subsp. nov.

PLATE 9.

Stems 50 to 70 cm. high, puberulent and somewhat viscid, the upper portions quite naked; basal leaves triternate; leaflets small, in type almost suborbicular, puberulent on both surfaces, glutinous beneath; flowers about 4 cm. long, 3 cm. across; sepals with a slender claw about 3 mm. long, broadly elliptic, obtuse or acute, bright red, reflexed, shorter than the spurs; laminae yellow, about 4 mm. long, truncate at apex; spurs red, extremely slender for about 10 mm. from apex, about 2 cm. long, the knob of nectary large; stamens long-exserted, about 1.7 cm. long; ovaries densely pubescent; follicles about 2 cm. long.

Type in the herbarium of M. E. Jones, collected at Panaca, Nevada, September 5, 1912, by M. E. Jones. Mr. Jones's specimen from Comet Peak, Pioche, August 30, 1912, and Heller's no. 11040 from Lee Canyon, Charleston Mountains, though not exactly similar to the type, are referred here. The name is given because of a fancied resemblance to a shooting star.

EXPLANATION OF PLATE 9.—*Aquilegia formosa caelifax* Payson. From the type specimen. About one-half natural size.

7. *Aquilegia shockleyi* Eastw. Bull. Torrey Club 32: 193. 1905.

Stems branching, glabrous on the lower part, viscid-pubescent on the upper, clothed at base with the persistent bleached remains of the leaves, about 40 cm. high; basal leaves triternate, varying in length from much shorter than the stem, scarcely reaching the lowest branches, to 50 cm. high with long, stout petioles; leaflets pale green, glabrous, but under the lens densely covered with shining yellow glands, cuneate in outline, 3-lobed with cuneate, deeply crenate lobes, the middle leaflet broad, petioluled, the lateral generally unequal-sided, often sessile; cauline leaves with short sheathing petioles, less compound, the upper ones 3-cleft, with narrowly linear, acute divisions; bracts simple, linear-acuminate; sepals lanceolate, obtuse, somewhat undulate, especially toward the short curved claw; blade 17 mm. long, 6 mm. broad; claw somewhat more than 2 mm. long; laminae truncate or rounded at apex, 5 to 6 mm. long, 4 mm. wide; spurs about 3 cm. long, attenuate for 6 mm. about the globular honey gland, then gradually dilating to the throat; ovaries pubescent; follicles spreading but little; seeds reddish brown.

Known only from the type collection, *Shockley* 504, from Soda Spring Canyon, Esmeralda County, western Nevada.

Aquilegia shockleyi is rather doubtfully distinct specifically from *A. formosa*. It is another of those perplexing forms into which *A. formosa* is seen to merge. Its characteristic peculiarities are the long spurs and the triternate leaves.

8. *Aquilegia wawawensis* sp. nov.

PLATE 10.

Stems erect, slender, glabrous or puberulent, about 40 cm. high; basal leaves on slender, rather weak petioles 15 to 20 cm. long, biternate or triternate; petiolules filiform, puberulent, rather short; leaflets small, very thin, glabrous, glaucous beneath, 3-lobed, each lobe rather sharply incised; cauline leaves few, similar; bracts of 1 to 3 incised leaflets clothing the upper portions of the stem; flowers on short, slender pedicels, 3 to 3.5 cm. long and about as wide, nodding; sepals pale red, ovate-elliptic, obtuse, reflexed, about 2 cm. long; laminae yellow, rounded, about 3 mm. long; spurs pale red, very slender, straight or slightly hooked at apex, about 2 cm. long, the nectary small; styles 10 mm. long; ovaries puberulent.

Type in the U. S. National Herbarium, no. 763898, collected at Wawawai, Washington, on the south bank of the Snake River, "in dripping water," May 26, 1906, by Rex Hunt (no. 203).

Aquilegia wawawensis is similar in many ways to *A. formosa*, and though no doubt an offshoot from that species, is apparently deserving of specific rank. It is of unusual appearance because of the almost membranous texture of the leaflets, the peculiar bracts which clothe the upper parts of the stem, and the small, pale red flowers with very slender spurs.

EXPLANATION OF PLATE 10.—*Aquilegia wawawensis* Payson. From the type specimen. About one-half natural size.

9. *Aquilegia tracyi* Jepson, Fl. West. Mid. Calif. ed. 2. 165. 1911.

PLATE 11.

Puberulent and viscid throughout; stems 50 to 100 cm. high; basal leaves triternate; leaflets variable in shape, rather large, glabrous beneath, the lobes often acute or pointed; flowers 4 to 6 cm. long, 3.5 to 4.5 cm. across, nodding; sepals red, reflexed, acute, 20 to 25 mm. long; laminae obsolete; spurs red, stout, spreading, 2.5 to 3.5 cm. long, the throat very broad, its orifice cut backward obliquely and not horizontally, abruptly contracted near apex; styles 13 to 18 mm. long; ovaries pubescent; follicles about 2 mm. long, the tips spreading.

TYPE LOCALITY: Flat Creek, Howell Mountain, California.

RANGE: North coast ranges of California from Marin to Napa and Mendocino counties.

REFERENCE: Jepson, Fl. Calif. 518. 1914.

SPECIMENS EXAMINED.

CALIFORNIA: Near Hullville, on the ridge between Eel River and Rice Creek, Lake County, *Heller* 6014. Crystal Springs Lake, San Mateo County, *Elmer* 4952, 4271. San Anselmo Canyon, Marin County, *Eastwood*. On San Carlos, *Brewer* 773. "Southeast California," *Palmer*.

This Californian species of peculiar aspect is related most closely to *A. formosa truncata*, but seems to be quite distinct. It is very different in appearance from any other American *Aquilegia*, and when once seen it is not to be confused with the closely related species. The broad orifices of the spurs with the obsolete laminæ, the long stamens and styles, and the distinctly triternate leaves are its most distinctive peculiarities.

EXPLANATION OF PLATE 11.—*Aquilegia tracyi* Jepson. From the specimen collected by Miss Alice Eastwood in San Anselmo Canyon. One-half natural size.

10. *Aquilegia lithophila* sp. nov.

Stems tufted, more or less irregularly ribbed, decidedly viscid throughout, 30 to 40 cm. high; leaves biternate, the petioles and petiolules viscid-pubescent; lateral leaflets sessile or short-petioluled, the terminal ones on slender petiolules about 1.5 cm. long, rather broad (in type specimen suborbicular, 3 to 4 cm. across), more or less finely pubescent and viscid, especially beneath, scarcely glaucous, the lobes rounded; flowers nodding, 4 to 4.5 cm. long, about 3 cm. across; sepals yellow or tinged with red, 1.5 to 2 cm. long, spreading; laminæ as well as the spurs bright yellow, less than 10 mm. long, rounded; spurs nearly 3 cm. long, gradually tapering from a broad base to a slender apex; ovaries pubescent; styles about 10 mm. long.

Type in the U. S. National Herbarium, no. 718898, collected in the canyon of the Dolores River above Mesa Creek, western Colorado, altitude about 1,500 meters, June 11, 1914, by E. B. Payson (no. 406).

An additional specimen seen is *Jones* 5298i, from near the head of Pahria Canyon, Utah.

An interesting and little known plant, collected, apparently, only in these two localities. The type grew from the crevices of a ledge in the bottom of a small side canyon over which trickled a tiny stream and from between whose strata the water was oozing. To see the plants in such a place, surrounded by huge sandstone cliffs, rocky, sun-baked hills, and a scattering forest of junipers, was a striking novelty to one accustomed to associating plants of this genus with the verdant meadows and cool groves of the higher mountain regions.

The sand is still clinging to the underside of the leaflets in the herbarium specimens, giving evidence of a peculiarity shared by two other species of this region found in similar habitats, namely, *A. ecalcarata* and *A. pallens*.

11. *Aquilegia canadensis* L. Sp. Pl. 533. 1753.

Aquilegia variegata Moench, Meth. Pl. 311. 1794.

Aquilegia elegans Salisb. Prodr. Stirp. 374. 1796.

Aquilegia coccinea Small, Bull. N. Y. Bot. Gard. 1: 280. 1899.

Aquilegia australis Small, Bull. Torrey Club 25: 466. 1899.

Aquilegia latiuscula Greene, Repert. Nov. Sp. Fedde 13: 320. 1914.

Aquilegia eminens Greene, Repert. Nov. Sp. Fedde 13: 321. 1914.

Stems 30 to 70 cm. high, frequently pubescent throughout; basal leaves biternate, usually rather large, glaucous and often pubescent beneath; flowers 3 to 4 cm. long, 2 to 3 cm. across, nodding; sepals red, lanceolate, usually acute or acuminate, slightly spreading, 15 to 20 mm. long, exceeding the laminæ 5 to 9 mm; laminæ yellow, rounded and more or less truncate at apex, the spurs red, straight, rather stout, about 20 mm. long, their tips often connivent; styles 12 to 15 mm. long; follicles usually 5, 2 to 2.5 cm. long, the tips spreading.

TYPE LOCALITY: "Habitat in Virginia, Canada."

RANGE: In rocky woods of Canada from Nova Scotia to the Northwest Territory, and throughout most of the eastern part of the United States nearly to the base of the Rocky Mountains.

REFERENCES: Jones, *Zoe* 4: 258. 1893. Robinson, *Syn. Fl.* 1: 44. 1895. J. Schneck, *Bot. Gaz.* 32: 304. 1901. Davis, *Minn. Bot. Stud.* 2: 335. 1899. Small, *Fl. Southeast. U. S.* 433. 1903. Robins. & Fern. in A. Gray, *New Man. Bot.* 405. 1908. Britt. & Brown, *Illustr. Fl. ed. 2.* 2: 92. 1913.

SPECIMENS EXAMINED (localities only).

CANADA: Kingston, Ontario; Algonquin Park, Ontario.

MAINE: Orono; Veazie.

NEW HAMPSHIRE: Hanover.

VERMONT: Smugglers Notch; Barnett.

MASSACHUSETTS: Weston; Shakes Glen; Fairmouth; Melrose.

CONNECTICUT: New Haven.

NEW YORK: Ithaca.

PENNSYLVANIA: Mount Ville; Glen Mills; Lancaster; Little Conestoga; Germantown; Allegheny River, Clarion County; Athens; Sayre; Locust Ridge; Pocono Plateau.

DISTRICT OF COLUMBIA: National Zoological Park.

VIRGINIA: Blue Ridge near Luray; Johnson County; Staunton.

NORTH CAROLINA: Tryon; side of Tryon Mountains, Polk County.

OHIO: Oxford; Benton; Canton; Hinckley, Medina County.

KENTUCKY: Bowling Green.

TENNESSEE: Knoxville.

MICHIGAN: Benton Harbor.

INDIANA: Notre Dame; Brookville, Franklin County; Great Falls.

ILLINOIS: Beach; St. Clair County; Bluff Lake; Proviso; Augusta; Peoria.

WISCONSIN: Ephraim.

MINNESOTA: Winona; Minneapolis; Mallory; Hennepin County.

NORTH DAKOTA: Fargo; Turtle Mountains, Rolette County.

SOUTH DAKOTA: Vermilion; Rockerville; Oakswood; Warrens Woods, Brookings County.

NEBRASKA: South Bend; Longpine; Gage.

KANSAS: Riley County; near Manhattan.

MISSOURI: Courtney; Monteer; Pulaski County; Cass County; Scott County; Jefferson County; Webb City; Allenton; Kennswick; Jerome; Victoria.

ARKANSAS: Corning, Benton County.

TEXAS: Temple.

A variable but on the whole quite homogeneous species, with the widest range of all North American *Aquilegias*. Segregates have been proposed, but they do not seem to represent constant differences, nor do they occur in restricted localities.

The variety *flaviflora* (Tenney) Britton¹ is only a yellow form of the species. Such forms are to be expected in all the red species. The variety *phippenii* J. Robinson² is a salmon-colored form found near Salem, Massachusetts.

12. *Aquilegia triternata* sp. nov.

Stems many from a thick, branched caudex, slender, usually densely pubescent throughout, 30 to 60 cm. high; basal leaves long-petioled, very markedly triternate, the leaflets borne on filiform pubescent petiolules 2 to over 10 mm. in length; leaflets small (13 to 18 mm. long), cuneate or even truncate at base, the lobes rounded or obtusely pointed, pubescent or glabrous above, usually densely white-pubescent beneath but not at all viscid; flowers about 4 cm. long, 2.5 to 3 cm. broad, nodding; sepals broadly ovate-lanceolate, acute, about 20 mm. long, light red, slightly spreading, exceeding the laminae 6 to 7 mm.; petals yellowish or pale red, about 7 mm. long,

¹ Bull. Torrey Club 15: 97. 1888.

² Bull. Torrey Club 15: 166. 1888.

rounded or truncate at apex; spurs light red, stout, 22 to 24 mm. long, contracted rather abruptly 6 or 7 mm. from apex, the knob of nectar gland large, the tips often more or less incurved; styles about 12 mm. long; ovaries viscid-pubescent.

Type in the U. S. National Herbarium, no. 718899, collected in moist places in Outlaw Canyon, Chiricahua Mountains, southern Arizona, July 30, 1907, by L. N. Goodding (no. 2325).

RANGE: At lower elevations in southern Arizona and western New Mexico, north into western Colorado. .

SPECIMENS EXAMINED.

ARIZONA: Between Barfoot and Idas peaks, Chiricahua Mountains, *Blumer* 1475. Asplenium Canyon, Mule Mountains, *Goodding* 998. Barfoot Peak, Chiricahua Mountains, *Blumer* 1441. Manning Camp, Rincon Mountains, *Blumer* 3591. Sitgreaves Camp, White River, *Goodding*. Near Flagstaff, *Leiberg* 5858, *MacDougal* 134 (?).

NEW MEXICO: Bear Mountain, near Silver City, *Metcalf* 162. Balsam Park, Sandia Mountains, *Ellis* 47. Sandia Mountains, *Wooton*.

COLORADO: Glenwood Springs, *Osterhout* 1951.

This seems to be one of the most distinct species of the *canadensis* group of the *Rhodanthæ*. Strangely enough, the less well marked forms have been the first to be characterized, and although this species has been collected from time to time, it has always been placed under other names. The extreme differentiation of *A. triternata* occurs in southern Arizona. This species is chiefly characterized by its extremely triternate leaves, its large, light red flowers, resembling those of *A. canadensis* in form, its stout, abruptly contracted spurs, and its copious pubescence. This last character is well marked and quite constant in appearance in the specimens from southern Arizona, but is often almost entirely lacking in plants from New Mexico and western Colorado. The species may be found to merge into *canadensis* in New Mexico.

13. *Aquilegia desertorum* (Jones) Cockerell, *Muhlenbergia* 1: 27. 1901.

Aquilegia formosa desertorum Jones, *Contr. West. Bot.* 8: 2. 1898.

Stems slender, glandular-hairy above, about 30 cm. high; basal leaves biternate, rarely over one-third as long as the stems; leaflets small, rather thick, pubescent, glaucous on both surfaces; cauline leaves several; bracts once or twice ternate; flowers nodding, 3.5 to 4 cm. long, 1.5 to 2 cm. across; sepals dark red, elliptic-lanceolate, about 1 cm. long, spreading, exceeding blade of petals about 3 mm.; laminae yellow, rounded, about 5 mm. long; spurs light red, straight, slender, 22 to 25 mm. long; ovaries pubescent; styles about 10 mm. long; follicles 1.5 to 2 cm. long, the tips widely spreading.

Known only from the type specimen, *Jones*, August 29, 1884, Flagstaff, Arizona, and from *MacDougal* 327, Walnut Canyon, same vicinity.

Grows in rock crevices near springs. A close relative of *A. elegantula*, but distinguished from it by the smaller leaflets which are glaucous on both surfaces, the presence of true cauline leaves in addition to the bracts, and the dark red, spreading sepals. Professor Cockerell says, in comparing this species and *A. elegantula*, that "*A. elegantula* is properly a forest loving species of higher altitudes, essentially a mesophytic plant. *A. desertorum*, as its name indicates, is xerophytic, living on rocky slopes in the transition zone, and is remarkable for its enormous root and long life * * * the plant comes into flower long before the other Rocky Mountain species * * *."

Professor Cockerell has published¹ a hybrid between *desertorum* and *chrysantha*. In color of flowers and time of flowering the hybrid is intermediate between the two parents, but Professor Cockerell says that "the form of the flowers departs from both parents in the direction of the *A. vulgaris* group."

¹ *Bot. Gaz.* 62: 413. 1916.

14. *Aquilegia rubicunda* Tidestrom, Amer. Mid. Nat. 1: 168. 1910.

More or less viscid-puberulent throughout, the stems few from a branched caudex, the crowns densely clothed with the petiole bases of old leaves; basal leaves mostly biternate though often approaching the triternate condition; leaflets rather small, narrow, mostly cuneate at base, the lobes rounded; stem leaves wanting; flowers about 3 cm. long, scarcely 2 cm. across, nodding; sepals oval, acute, pinkish, 1 cm. long or more, exceeding the laminæ by 6 or 7 mm.; laminæ light yellow, slightly spatulate, 5 mm. long or more; spurs pale red, slender, mostly less than 2 cm. long; stamens twice as long as the petals; ovaries glabrous.

Known only from the type specimen, collected by Mr. I. Tidestrom along "Link Trail," near Emery, Manti National Forest, Utah.

Other collections are necessary to establish this species with certainty, but on the whole its characters seem fairly good. It is closely related to *A. elegantula* and if reduced to subspecific rank should be placed under that species. It differs from *elegantula* in the viscid character of the pubescence, the somewhat more dissected leaves, the narrow segments of the leaflets, and the lighter colored flowers with longer sepals and more slender spurs.

15. *Aquilegia elegantula* Greene, Pittonia 4: 14. 1899.

PLATE 12.

Aquilegia canadensis L. err. det. Coulter, Man. Rocky Mount. 10. 1885.

Stems slender, usually not more than 30 cm. high, mostly glabrous; basal leaves biternate, the stem leaves few, the leaflets small, glabrous, glaucous beneath; flowers 3 to 3.5 cm. long, 1.2 to 1.8 cm. across, nodding; sepals entirely red or with yellowish or greenish tips, ovate-oblong, erect, 10 mm. long, exceeding the laminæ by only 1 to 3 mm.; laminæ yellow, about 8 mm. long; spurs scarlet, straight, somewhat inflated above and abruptly narrowed about 5 mm. from the apex, 20 mm. long; styles 12 to 15 mm. long; ovaries pubescent; follicles 5, 1.5 to 1.8 cm. long, the tips erect or spreading.

TYPE LOCALITY: Near Mancos, Colorado.

RANGE: In the mountains of southwestern Colorado, adjacent Utah, northern New Mexico, and probably Arizona, at elevations between 2,250 and 3,300 meters.

REFERENCES: Davis, Minn. Bot. Stud. 2: 334. 1899. Rydb. Colo. Agr. Exp. Sta. Bull. 100: 136. 1906. A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909. Woot. & Standl. Contr. U. S. Nat. Herb. 19: 248. 1915.

SPECIMENS EXAMINED.

COLORADO: Slide Rock Canyon near Mancos, *Baker, Earle & Tracy* 237 (type collection). Silverton, San Juan County, *Crandall* 609. Minturn, Eagle County, *Osterhout* 2563. Black Canyon of the Gunnison River, *Payson* 13. Tabeguache Basin, Montrose County, *Payson* 472. Near Cimarron, *Baker* 211. Sapinero, Gunnison County, *Wheeler* 560. Telluride, *Jones*. La Plata Mountains, *Tweedy* 503. Dry Creek, Uncompahgre National Forest, *Tidestrom* 1542. Vicinity of Mount Carbon, Gunnison County, *Eggleston* 5687. Ouray, *Shear* 4918. Head of Vallecito, *Knowlton* 51.

UTAH: Sierra La Sal, *Purpus* 6570. West Indian Creek, *Rydb. & Vreeland* 6207.

Dark Canyon, San Juan County, *Walker* 260. La Sal Mountains, *Jones*.

NEW MEXICO: *Fendler*. Hematite, *Berg*. Sacramento Mountains, Otero County, *Wooton*. Beulah, *Cockerell* 89. Winsor Creek, Pecos National Forest, *Standley* 4031. Vicinity of Cloudcroft, Otero County, *Wooton*. White Mountains, Lincoln County, *Wooton*. Eagle Creek, Lincoln County, *Wooton*. Luna, *Wooton*. Nine miles east of Santa Fe, *Heller* 3691.

This beautiful species of the Transition and Canadian zones of the southern Rocky Mountains is one of the smallest-flowered and one of the daintiest of American *Aquilegias*. Though evidently most nearly related to *A. canadensis* of the eastern hills, it is easily distinguished from that species by its smaller, more graceful habit of growth

and especially by its much more slender, more truly scarlet flowers with their short, closely appressed sepals.

EXPLANATION OF PLATE 12.—*Aquilegia elegantula* Greene. From Payson 13, Black Canyon of the Gunnison River, Colorado. One-half natural size.

16. *Aquilegia skinneri* Hook. in Curtis's Bot. Mag. 68: pl. 3919. 1842.

Aquilegia mexicana Hook. in Curtis's Bot. Mag. 68: pl. 3919. 1842.

Aquilegia madrensis Rose, Contr. U. S. Nat. Herb. 12: 265. 1909.

Stems 60 to 100 cm. high; basal leaves long-petioled, triternate, the leaflets on slender petiolules or sessile, relatively small, the lobes rounded, more or less pubescent beneath; flowers 5.5 to 7 cm. long, 3.5 to 4 cm. across, nodding; sepals greenish yellow, lanceolate, acuminate, 18 to 24 mm. long, more or less spreading, exceeding the laminae by 7 to 10 mm.; laminae yellowish, truncate or rounded, 8 to 10 mm. long; spurs pale red, straight, uniformly or abruptly tapering from base to apex, 3.5 to 5 cm. long; styles, in fruit, 18 to 20 mm. long; ovaries pubescent; follicles about 3 cm. long, the tips slightly spreading.

TYPE LOCALITY: "In the mountains of Guatemala."

RANGE: In the Sierra Madre of northern Mexico.

REFERENCES: S. Wats. Gard. & For. 1: 31. 1888. Davis, Minn. Bot. Stud. 2: 339. 1899.

SPECIMENS EXAMINED.

MEXICO: Sierra Madre, Chihuahua, *Pringle* 1182. West of Bolaños, Jalisco, *Rose* 2954. Guanacevi, Durango, *Nelson* 4762. Colonia García, Chihuahua, *Townsend & Barber* 78. Southwestern Chihuahua, *Palmer* 336. Largo Canyon, Chihuahua, *Jones*.

Aquilegia skinneri is the longest spurred as well as the southernmost known species of the section *Rhodanthae*, and is of peculiar appearance because of its light greenish sepals and laminae and its pale red spurs. It has been introduced into cultivation to some extent and is a beautiful plant.

The above description was based on specimens collected in northern Mexico. These, according to Dr. J. N. Rose, should be called *A. madrensis*, which, he says, "must be distinct, judging from the descriptions and colored figure of that species" (*skinneri*). According to Dr. Rose the plants from northern Mexico differ from *A. skinneri* (as described and illustrated) in their taller stature, pubescent stems and leaves, broader sepals, different leaf segments, and paler flowers. However, it is better to retain the name *A. skinneri* for the plants of northern Mexico for the present at least, since it seems probable that the type came from Chihuahua instead of Guatemala, and that labels were mixed in England. Neither can the characters by which *A. madrensis* was separated from *A. skinneri* be considered specific in this genus.

17. *Aquilegia jonesii* Parry, Amer. Nat. 8: 211. 1874.

Densely tufted and cespitose, the stems very short or wanting; leaves tufted at apex of branches of rootstock, 3 to 6 cm. high, biternate, the primary divisions with very short, if any, partial petioles, the leaflets sessile or confluent at base, much congested, thick, pubescent on both surfaces, deeply divided into 3 or 4 entire, narrowly oblong, obtuse segments; flowers erect, solitary, borne on naked, softly pubescent scapes 3 to 8 cm. long, exceeding the leaves; sepals blue, oblong, obtuse, equaling or exceeding the spurs and twice the length of laminae and head of stamens; laminae blue; spurs gradually tapering, straightish; styles about 1 cm. long; ovaries smooth; follicles 5, 2 to 2.5 cm. long, the tips slightly spreading.

TYPE LOCALITY: Phlox Mountain, northern Wyoming.

RANGE: Alpine in the mountains of northern Wyoming, Montana, and adjacent Canada.

REFERENCES: Rose, Bot. Gaz. 15: 63. 1890. Jones, Zoe 4: 258. 1893. Robinson, Syn. Fl. 1: 43. 1895. Rydb. Contr. U. S. Nat. Herb. 3: 482. 1896. Davis, Minn. Bot. Stud. 2: 335. 1899. Rydb. Mem. N. Y. Bot. Gard. 1: 154. 1900.

SPECIMENS EXAMINED.

CANADA: Sheep Mountain (lat. 59° 05'), *Macoun*.

MONTANA: Little Belt Mountains, *Flodman* 451. Upper Marias Pass, *Canby* 13.

Yogo, Belt Mountains, *Williams* 764. Park County, *Tweedy*.

WYOMING: Northwest Wyoming, *Parry* 3. Whisky Mountain, *Cary* 31. Summit of Hunt Mountain, Big Horn Range, *Jack*.

An anomalous and very remarkable species of this section, showing some relationship to the section *Cyrtoplectrae*, to the species of which it has heretofore been thought to be related. This has resulted, no doubt, from the fact that *A. jonesii* possesses very short spurs. The large, erect flowers, the long styles, and the straight spurs show that it is really much closer to *A. caerulea* than to the *brevistyla* group. Its extremely cespitose habit, its very small leaves with their closely clustered leaflets, and its large flowers on very short scapes give this species an entirely different aspect from all other columbines, except, perhaps, *A. scopulorum*.

18. *Aquilegia caerulea* James in Long, Exped. 2: 15. 1823.

Aquilegia macrantha Hook. & Arn. Bot. Beechey Voy. 317. pl. 72. 1839-40.

Stems 40 to 80 cm. high, usually glabrous below, more or less viscid-pubescent in the inflorescence; leaves mostly basal, biternate, reduced upward and occasionally becoming entire in the inflorescence, the leaflets glabrous, glaucous beneath, variable in size but usually large; flowers 6 to 8 cm. long, 6 to 10 cm. across, usually erect; sepals typically a deep blue purple, ovate-oblong, acute or obtuse, spreading, 30 to 40 mm. long, exceeding the laminae about 10 mm.; laminae white, ovate-spatulate, rounded at apex; spurs usually pale blue, slender, straight or spreading, 35 to 45 mm. long; styles 7 to 9 mm. long; ovaries densely pubescent; follicles 5 to 8, 2 to 3 cm. long, the tips spreading.

TYPE LOCALITY: On the divide between the Platte and the Arkansas, Colorado.

RANGE: At higher elevations in the Rocky Mountains from northern New Mexico to Montana.

REFERENCES: Hook. in Curtis's Bot. Mag. 90: pl. 5477. 1864. Jones, Zoe 4: 256. 1893. Robinson, Syn. Fl. 1: 44. 1895. Davis, Minn. Bot. Stud. 2: 342. 1899. Rydb. Colo. Agr. Exp. Sta. Bull. 100: 136. 1906. A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909. Woot. & Standl. Contr. U. S. Nat. Herb. 19: 248. 1915.

SPECIMENS EXAMINED (localities only).

COLORADO: Larimer County; Uncompahgre Divide; Telluride; Arapahoe Peak; Tolland; Poudre River, Larimer County; North Cheyenne Canyon; Clear Creek; Mount Baldy; Mount Ouray; near Georgetown; Middle Park; Cameron Pass; Uncompahgre Canyon; Estes Park; Leadville; Berthoud Pass; Hahns Peak; Como and vicinity; Florissant; above Beaver Creek; forks of Poudre and Big Tooth Rivers; Horsetooth Gulch; Table Rock; Graymont; Rist Canyon; Manitou; Pikes Peak; near Breckenridge; Mount Hesperus; Anita Peak; Bob Creek, Montezuma County.

MONTANA: Lima.

WYOMING: Laramie Hills; Telephone Canyon; Medicine Bow Mountains.

UTAH: Geyser Canyon; Beaver Creek; Big Cottonwood Canyon; Dyer Mine, Uintah Mountains; Thousand Lake Mountain; Mount Nebo; Mount Ellen; La Sal Mountains.

NEW MEXICO: Pecos River National Forest; "northern New Mexico."

Aquilegia caerulea is without doubt the most showy and splendid American species of this genus. While it is found in most of the Rocky Mountain States, it was chosen as the State flower of Colorado, and in that State it reaches its finest development. There, in the Canadian zone, among the aspens, spruces, and firs, it is not uncommon to see a hillside meadow so completely covered with *A. caerulea* as to hide all other vegetation and to make it seem a fairyland of huge, dancing, blue and white stars;

nor is it a view soon to be forgotten. This species is probably the most representative one of its group and from some *caerulea*-like ancestor we may imagine the related species to have sprung.

The type and several subspecies may be distinguished by the aid of the key below. There are, besides, two forms characterized by Professor Cockerell,¹ both found about the "Lakes of the Clouds" in Custer County, Colorado. These are: The forma *pallidiflora*, described as with smaller, paler flowers and larger leaves than the species, and as having 5 pods; and the forma *glandulosa*, with 6 pods, the pods and peduncles pubescent and glandular-viscid.

Sepals blue.

Spurs present.

Petals yellow. Plant of northwestern Wyoming..18c. *A. caerulea alpina*.

Petals white.....18. *A. caerulea*.

Spurs wanting.....18d. *A. caerulea daileyae*.

Sepals white.

Spurs about 7 cm. long.....18b. *A. caerulea pinetorum*.

Spurs not over 6 cm. long.....18a. *A. caerulea albiflora*.

18a. *Aquilegia caerulea albiflora* A. Gray; Robinson, Syn. Fl. 1: 44. 1895.

Aquilegia leptocera Nutt. Journ. Acad. Phila. 7: 9. 1834.

Aquilegia caerulea ochroleuca Hook. in Curtis's Bot. Mag. 90: pl. 5477. 1864.

Aquilegia caerulea leptocera A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909.

RANGE: Mostly west of the Rocky Mountains in Utah, Nevada, and Idaho, and at lower elevations.

REFERENCES: S. Wats. in King, Geol. Expl. 40th Par. 5: 10. 1871. A. Gray, Pl. Wright. 2: 9. 1853. Tidestrom, Amer. Mid. Nat. 1: 171. 1910.

SPECIMENS EXAMINED.

IDAHO: Palisade National Forest, *Ryder* 13. Lost River Mountains, west of Clyde, Blaine County, *Macbride & Payson* 3113.

WYOMING: Pine Mountain, *Nelson* 3557. North Fork Lake, *Warren* 8. Between Baggs and Rawlins, *Osterhout* 2634.

COLORADO: Cameron Pass, *Baker*. Sangre de Cristo Creek, *Rydberg & Vreeland* 6211.

UTAH: Provo, *Jones* 5569. Uintah Mountains, *H. Engelmann*. Vicinity of Clayton Peak, Wasatch Mountains, *Stokes*. Alta, Wasatch Mountains, *Jones* 1212. Black Mountain, Manti, *Jones*. Head of Bullion Creek, *Jones*. Aqui Mountains, *Jones*. Little Cottonwood Canyon, *Jones*. Henry Mountains, *Jones* 5695a.

NEVADA: Piermont, *Jones*. Schell Creek Mountains, *Jones*.

This subspecies might perhaps be regarded as a color form if it were not for its peculiar relationship to *A. caerulea*. Though it seems to differ from the species only in its color, this difference is more significant than in most color forms. This subspecies seems to show a higher plane of evolution than the species; it is the form that has migrated westward, has become adapted, in general, to a more arid habitat, and has made the first advance to the yellow color which, under some circumstances, is the forerunner of red, the most specialized color of all. One would suppose if these flowers are pollinated by moths that the white flowers would have a decided advantage over the blue.

18b. *Aquilegia caerulea pinetorum* (Tidestrom).

Aquilegia pinetorum Tidestrom, Amer. Mid. Nat. 1: 166. 1910.

Stems and leaves as in *A. caerulea*; flowers white, resembling those of the subspecies *albiflora*, somewhat smaller than in typical *caerulea*; spurs slender, straight, about 7 cm. long.

TYPE LOCALITY: Buckskin Mountains, Arizona.

RANGE: Northern Arizona and southern Utah.

¹ Bull. Torrey Club, 18: 168. 1891.

SPECIMENS EXAMINED.

ARIZONA: *Pinus ponderosa* area, Warm Spring Canyon, Buckskin Mountains, *Tidestrom* 2329 (type).

UTAH: Sevier National Forest. Mount Ibapah, *Jones*.

This plant is to be distinguished from the subspecies *albiflora* by the very long, slender spurs. The length of the spurs in this subspecies, though otherwise unusual in the species, can scarcely be considered of specific value, since the spurs of the typical form occasionally exhibit an equal length. I have at hand a specimen of *A. caerulea* from the La Sal Mountains of Utah (*Jones*, June 13, 1913), with dark blue sepals and with spurs quite as long as those of this subspecies. A specimen from the Laramie Hills, Albany County, Wyoming (*Nelson* 249, June 22, 1894), also has spurs nearly 7 cm. in length. The altitudes at which this form grows are somewhat lower than those at which the species is found (about 2,100 meters).

18c. *Aquilegia caerulea alpina* A. Nels. First Rep. Fl. Wyo. 78. 1896.

Aquilegia oreophila Rydb. Bull. Torrey Club 29: 146. 1902.

Stems 40 to 60 cm. high; lower leaves biternate, the leaflets large, thin; flowers few, 3 to 5 cm. long, erect; sepals pale blue; petals yellow or ochroleucous.

TYPE LOCALITY: Union Peak, Wind River Mountains, Wyoming.

RANGE: Northwestern Wyoming, at high elevations.

SPECIMENS EXAMINED.

YELLOWSTONE NATIONAL PARK: Snake River, A. & E. *Nelson* 6412.

WYOMING: Union Peak, *Nelson* 894. Teton Pass, *Merrill & Wilcox* 979.

Differing from the species by such slight characters that it is often difficult to decide as to the identity of a particular specimen. The color of the flowers of this reminds one of the flowers of *A. scopulorum*, but, unlike *scopulorum*, it has no distinguishing habit of growth.

18d. *Aquilegia caerulea daileyae* Eastw. Proc. Calif. Acad. III. 1: 76. 1897.

Spurs entirely wanting; sepals and petals similar, flat, blue.

Type from Estes Park, Colorado. These so-called "stellate" forms seem to occur occasionally in most of the species.

19. *Aquilegia ecalcarata* Eastw. Zoe 2: 226. 1891.

Aquilegia micrantha mancosana Eastw. Proc. Calif. Acad. III. 1: 77. 1897.

Aquilegia micrantha ecalcarata Davis, Minn. Bot. Stud. 2: 336. 1899.

Aquilegia eastwoodiae Rydb. Bull. Torrey Club 29: 146. 1902.

Aquilegia mancosana Cockerell, Torreya 11: 75. 1911.

Stems 30 to 50 cm. high, pubescent and viscid throughout, more or less irregularly ribbed; basal leaves triternate, the leaflets sessile or short-petioluled, rather small and narrow, the lobes obtuse or acute, thick, densely pubescent and viscid beneath; flowers about 2 cm. across, erect (?); sepals creamy white, ovate, acute, 10 mm. long, 4 mm. broad; laminæ creamy white, truncate or slightly retuse, about 7 mm. long and 5 mm. broad; spurs white, reduced to saclike outgrowths at the base of the petals; styles 5 to 7 mm. long; ovaries viscid-pubescent; follicles 4 or 5, about 15 mm. long, the tips spreading.

TYPE LOCALITY: Johnston Canyon, Mesa Verde National Park, Colorado.

RANGE: Known only from the type locality.

REFERENCES: Eastw. Zoe 2: 226. 1891. *Jones*, Zoe 4: 259. 1893. *Robinson*, Syn. Fl. 1: 43. 1895. *Davis*, Minn. Bot. Stud. 2: 336. 1899. A. Nels. in *Coulter*, New Man. Rocky Mount. 191. 1909.

Miss Eastwood says that this plant has been seen in but one nichelike cavern, where the sun never comes and where the supply of water is so slight during the hot, dry summer that it is forced to cling close to the damp rocks, even climbing up the sides of the cave with its slender, threadlike stems. While the species has been found in only one locality, the subspecies is said to be common in the canyons of the San Juan River system in southwestern Colorado and southeastern Utah at altitudes of less than 2,100 meters.

After this species was discovered (in 1891), Mr. Jones¹ made the section *Pseud-aquilegia* to contain it, based on its spurless flowers and triternate leaves. Later, when the subspecies was found (in 1894), Miss Eastwood made the characterization of this new section to read, "leaves triternate, spurs irregular or abortive, flowers small." There seems to be no occasion to consider this species as representing a new section. Triternate leaves are known to occur in at least two sections of the genus and the character of the spur does not appear to be significant of more than specific individuality. On the other hand, its erect, white or cream-colored flowers, its comparatively large, dilated laminæ, its outwardly curved, rather than hooked, slender spurs, and even its fragrance, seem to ally it to the *caerulea* group.

19a. *Aquilegia ecalcarata micrantha* (Eastw.)

Aquilegia micrantha Eastw. Proc. Calif. Acad. II. 4: 559. 1895.

Differs from the species in no significant way except by the development of the spurs, these straight or curved outward, 12 to 18 mm. long.

TYPE LOCALITY: Near Bluff City, southeastern Utah.

RANGE: In canyons of southwestern Colorado and adjacent Utah, in the Upper Sonoran Zone.

SPECIMENS EXAMINED.

UTAH: Near Bluff City, *Eastwood*. Armstrong and White canyons, near the Natural Bridges, *Rydborg & Garrett* 9488.

20. *Aquilegia pallens* Payson, Bot. Gaz. 60: 375. 1915.

PLATE 13.

Stems tufted, pubescent, glandular, sparsely villous throughout, 30 to 60 cm. high; basal and lower cauline leaves long-petioled, biternate; petioles and particularly the petiolules more or less glandular and villous with spreading hairs; leaflets rather small, broadly cuneate to suborbicular, thickish, glabrate or finely pubescent above, densely pubescent and viscid beneath; flowers about 3 cm. across, 5 cm. long, erect or merely inclined; sepals white or very pale blue, rather broad, mostly obtuse, spreading horizontally or slightly reflexed, about 20 mm. long; laminæ white, 8 to 10 mm. long, somewhat spatulate, broadly rounded or truncate at apex; spurs white, slender, straight or spreading, about 3 cm. long, the knob of nectary small; styles about 10 mm. long; ovaries pubescent and viscid; follicles less than 2 cm. long.

TYPE LOCALITY: Canyon of La Sal Creek, Utah, near the Colorado boundary.

RANGE: In the Upper Sonoran Zone of western Colorado and adjacent Utah.

SPECIMENS EXAMINED.

COLORADO: Near Grand Junction, *Payson* 712.

UTAH: La Sal Creek Canyon, *Payson* 443 (type). Moab, *Jones*. Green River, *Jones*.

A relative of *A. caerulea* and retaining the biternate leaves of that species although growing in a hot, arid region. Distinguished from it by its much smaller flowers and the viscid-pubescent leaflets and stems, to which grains of sand may usually be found clinging.

Found usually beneath cliffs where the soil is moist with oozing ground water in the early summer, but is quite dry later in the year.

EXPLANATION OF PLATE 13.—*Aquilegia pallens* Payson. From the specimen collected by M. E. Jones at Moab, Utah. Slightly less than one-half natural size.

¹ Zoe 4: 259. 1893.

21. *Aquilegia scopulorum* Tidestrom, Amer. Mid. Nat. 1: 167. 1910.*Aquilegia caerulea calcarea* Jones, Proc. Calif. Acad. II. 5: 619. 1895.*Aquilegia scopulorum* forma *calcarea* Tidestrom, Amer. Mid. Nat. 1: 170. 1910.

Cespitose alpine perennial, the stems 8 to 15 cm. long, more or less viscid-pubescent, especially above; basal leaves forming a dense tuft on the apices of the large caudex, biternate; cauline leaves mostly reduced to 1 or 2 entire or 3-lobed bracts; leaflets small, about 1 cm. broad, coriaceous, rounded, the base truncate; flowers solitary, erect, about 5 cm. long; sepals pale blue, broadly oblong, obtuse or acute, 3 to 4 cm. long; petals yellow or white, oblong, the apices rounded; spurs straight, 3 to 4 cm. long; ovaries densely pubescent; styles about 5 mm. long; follicles about 2 cm. long, the tips spreading.

TYPE LOCALITY: Wasatch Peak, central Utah.

RANGE: High altitudes in Utah, Nevada, and southwestern Wyoming.

SPECIMENS EXAMINED.

WYOMING: Bridger Peak, *Cary* 635.

UTAH: Wasatch Peak, *Tidestrom* 1788 (type). Divide between Sevier and Beaver rivers, near Belknap Peak, *Rydberg & Carlton* 7334. Canyon above Tropic, *Jones* (type of *A. caerulea calcarea*). Gold Mountain, near Marysvale, *Jones*.

NEVADA: Bunker Hill, Lander County, *Kennedy* 4181, *Hitchcock* 884.

An alpine relative of *A. caerulea*, differing from that species by its low, one-flowered stems, its very small, congested, coriaceous leaflets, and its smaller, light blue and yellow flowers. It is extremely difficult, if at all possible, to separate the form *calcarea* from the species *scopulorum*.

22. *Aquilegia pubescens* Coville, Contr. U. S. Nat. Herb. 4: 56. *pl.* 1. 1893.

Stems 20 to 30 cm. high, glabrous below or minutely pubescent throughout; basal leaves from once to twice ternate; leaflets medium in size, glabrate to densely pubescent beneath, the lobes rounded; stem leaves few or none, passing into linear tripartite bracts; flowers few, canary yellow throughout, erect, 4 to 5.5 cm. long, 4.5 to 6 cm. across; sepals linear-oblong, bluntly acute, 20 to 25 mm. long, spreading horizontally; laminae 8 to 14 mm. long, truncate or retuse at apex; spurs 35 to 40 mm. long, straight or spreading; styles 10 to 15 mm. long; ovaries pubescent.

TYPE LOCALITY: White Chief Mine, Mineral King, Tulare County, California (*Coville* 1513).

RANGE: Alpine in the Sierra Nevada of California from Tulare County to Mariposa County.

SPECIMENS EXAMINED.

CALIFORNIA: White Chief Mine, Tulare County, *Hall* 5654. "Sierra Nevada,"

Muir 4259. Olancho Mountain, Tulare County, *Hall & Babcock* 5230. Mount Goddard, *Hall & Chandler* 671. Hacketts Meadow, Tulare County, *Baker* 4378. Kearsarge Pass, Fresno County, *Clemens*. Vicinity of Lundy, Mono County, *Minthorn*. Bloody Canyon, *Brewer* 1811. Mono Pass, *Bolander*.

This species of the high California Sierra is somewhat similar to *A. chrysantha* of the warmer and drier mountains of New Mexico and Arizona, but is distinguished from it by the much less dissected leaves, lower habit of growth, and fewer, smaller flowers. The illustration accompanying the description of this species is excellent. Jepson¹ says: "The typical pubescent form occurs south of Kings Canyon; the specimens received by us from north of Kings Canyon are glabrous or nearly so."

¹ Fl. Calif. 518. 1914.

23. *Aquilegia chrysantha* A. Gray, Proc. Amer. Acad. **8**: 621. 1873.

Aquilegia leptocera flava A. Gray, Pl. Wright. **2**: 9. 1853.

Aquilegia leptocera chrysantha Hook. f. in Curtis's Bot. Mag. **99**: pl. 6073. 1873.

Aquilegia thalictrifolia Rydb. Bull. Torrey Club **29**: 145. 1902.

Stems 90 to 120 cm. high, much branched above, more or less pubescent; basal leaves usually triternate; leaflets usually rather small, often densely pubescent, beneath; flowers 6 to 9 cm. long, 4.5 to 7 cm. across, erect, of a clear yellow color throughout; sepals widely spreading, 3 to 3.5 cm. long, mostly narrow and long-acuminate; laminae of petals 1 to 2 cm. long, somewhat dilated above and rounded at apex, widely spreading; spurs very slender, straight or spreading, 5 to 7 cm. long; styles 10 to 13 mm. long; ovaries densely viscid-pubescent; follicles about 2.5 cm. long, the tips widely spreading.

TYPE LOCALITY: "Wet places in a ravine," Organ Mountains, New Mexico.

RANGE: In the mountains of southern Colorado, New Mexico, and adjacent Texas, Mexico, and Arizona.

REFERENCES: Coulter, Contr. U. S. Nat. Herb. **2**: 9. 1891. Rothr. in Wheeler, Rep. U. S. Surv. 100th Merid. **6**: 58. 1878. Jones, Zoe **4**: 257. 1893. Davis, Minn. Bot. Stud. **2**: 341. 1899. A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909. Woot. & Standl. Contr. U. S. Nat. Herb. **19**: 248. 1915.

SPECIMENS EXAMINED.

COLORADO: Colorado Springs, *Soth, Osterhout* 788. Cheyenne Mountain, *Broadhead*. Near Canyon City, *Brandegge*. Cheyenne Canyon, *Jones* 936b. Bear Creek Canyon, El Paso County, *Sheldon* 334.

NEW MEXICO: Organ Mountains, *Wooton* 628, *Vasey, Parry, Standley, Wright* 1306. Mogollon Mountains, Socorro County, *Wooton*.

ARIZONA: Miller Canyon, Huachuca Mountains, *Goodding* 175. Chaperon Canyon, Chiricahua Mountains, *Blumer* 1545. Aspen Gulch, Rincon Mountains, *Blumer* 3375. Monument Peak, Chiricahua Mountains, *Blumer* 1454. Flagstaff, *Purpus* 8077. Fort Whipple, *Coues & Palmer* 27. Santa Rita Mountains, *Pringle* 13612. Oro Blanco, *Kempton*. Fort Huachuca, *Wilcox, Patzky* 64. Rincon Mountains, *Nealley* 124. Fort Whipple, *Coues*. Santa Rita Mountains, *Thornber* 277. Prisal Mountains, *Jones*. San Francisco Mountains, *MacDougal, Knowlton* 73. Mint Valley, *Smart* 303. Bradshaw Mountains, *Toumey* 38a. Near Leroux Spring, *Leiberg* 5572. Natural Bridge, *Chamberlain* 58. Little Spring, *Goldman* 2113. Prescott, *Kunze*. Gila Canyon, *Mohr*.

MEXICO: Mabibi, Sonora, *Thurber* 434. San Luis Mountains, *Mearns* 1. San José Mountains, Sonora, *Mearns* 1679. Canyon near Chuchuichupa, Chihuahua, *Hartman* 725.

A variable species, resembling *A. caerulea*, but easily distinguished from it, although differing in but few constant technical characters except color. The spurs are, as a rule, longer and more slender, the sepals acuminate instead of acute or obtuse and narrower, the basal leaves more divided (triternate instead of biternate), and the plant taller and more floriferous. Its range, too, is farther south and the stations at which it is found at lower altitudes.

24. *Aquilegia chaplinei* Standley, sp. nov.

Stems slender, glabrous except in the inflorescence, about 35 cm. high; basal leaves borne on slender petioles 7 to 10 cm. long, scarcely triternate; leaflets small, suborbicular or somewhat narrowed, 10 to 12 mm. long, glabrous, thickish and firm; flowers about 3 cm. across, 5 to 6 cm. long, mostly erect; sepals spreading, yellow or slightly tinged with blue, broadly lanceolate, acute or obtuse, 13 to 15 mm. long, equaling or but little exceeding the laminae of the petals; laminae yellow, dilated, truncate or rounded; spurs very slender, straight or spreading, 3.5 to 4 cm. long, the

knob of nectary small; stamens well exerted; styles 10 to 12 mm. long; ovaries pubescent and glandular; mature follicles unknown.

Type in the U. S. National Herbarium, no. 537658, collected at Sitting Bull Falls, Alamo National Forest, southern New Mexico, altitude about 1,650 meters, May 25, 1916, by W. R. Chapline (no. 544).

This species is closely related to *A. chrysantha* and is probably no more than a local offshoot from that species. It is apparently deserving of specific rank, this to be based on its small flowers with subequal sepals and laminae and on the small leaflets. The altitude suggests that this plant is native in a more arid region than is its parent, *A. chrysantha*. It probably blooms earlier than the related plant does.

25. *Aquilegia longissima* A. Gray, Proc. Amer. Acad. 17: 317. 1882. PLATE 14.

Stems about 90 cm. high; basal and lower stem leaves similar, triternate, the partial petioles very long; leaflets deeply lobed, with narrow segments; flowers erect, pale yellow; sepals narrowly lanceolate, acuminate, broadly spreading, about 2.5 cm. long, exceeding the narrowly spatulate petals by 2 to 3 mm.; laminae spreading horizontally, rounded at apex; spurs filiform, hanging, 10 to 15 cm. long, the orifice narrow (about 2 mm.).

TYPE LOCALITY: Caracol Mountains, south of Monclova, Coahuila, Mexico.

RANGE: Ravines in the mountains of southwestern Texas and adjacent Mexico.

REFERENCES: A. Gray, Bot. Gaz. 8: 295. 1883. S. Wats. Gard. & For. 1: 31. 1888. Coulter, Contr. U. S. Nat. Herb. 2: 9. 1891. Jones, Zoe 4: 257. 1893. Robinson, Syn. Fl. 1: 45. 1895. Davis, Minn. Bot. Stud. 2: 341. 1899.

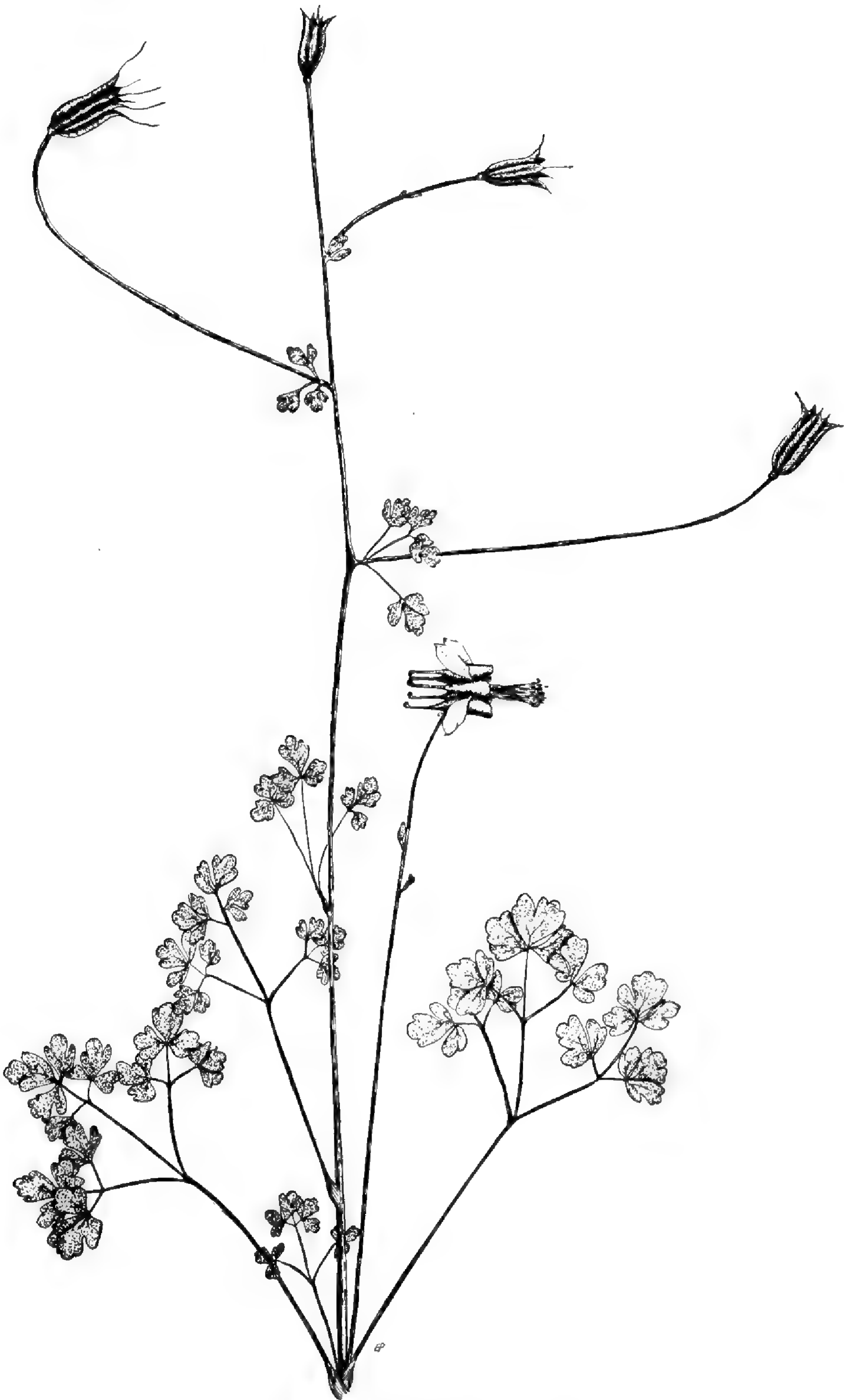
The only specimen seen was collected by Edward Palmer in Coahuila, Mexico.

Aquilegia longissima is most closely related to *A. chrysantha*, yet it differs from it in several important respects besides the length of the spurs. The blades of the petals, which in *A. chrysantha* are often widely spreading, in this species are bent nearly at right angles to the spurs and so assume a horizontal position. The sepals in *longissima* are narrower and exceed the petals by much less than in *chrysantha* and the flowers in *longissima* are produced in the fall when the flowers of the related species are much past their prime.

Aquilegia longissima is probably the most peculiar and interesting as well as the most highly developed species of *Aquilegia*. It is the southernmost known species of the section *Macroplectrae*. Its most remarkable character is, of course, its extraordinary spur length. This unusual length must have been developed in conjunction with the proboscis of some insect, and in this connection Doctor Trelease¹ says that the spurs of this, as well as the very long tubes of some other southwestern plants, might well be drained by *Amphonyx antaeus* Drury, a moth which possesses a proboscis over 5 inches in length. It would be interesting if some one who has an opportunity would test the truth of Doctor Trelease's conjecture. In the eastern United States *A. longissima* will not develop seeds unless artificially pollinated, thus showing its dependence on some animal not native to this section of the country.

EXPLANATION OF PLATE 14.—*Aquilegia longissima* A. Gray. From a cut in Garden and Forest 1:31. 1888. Slightly less than natural size.

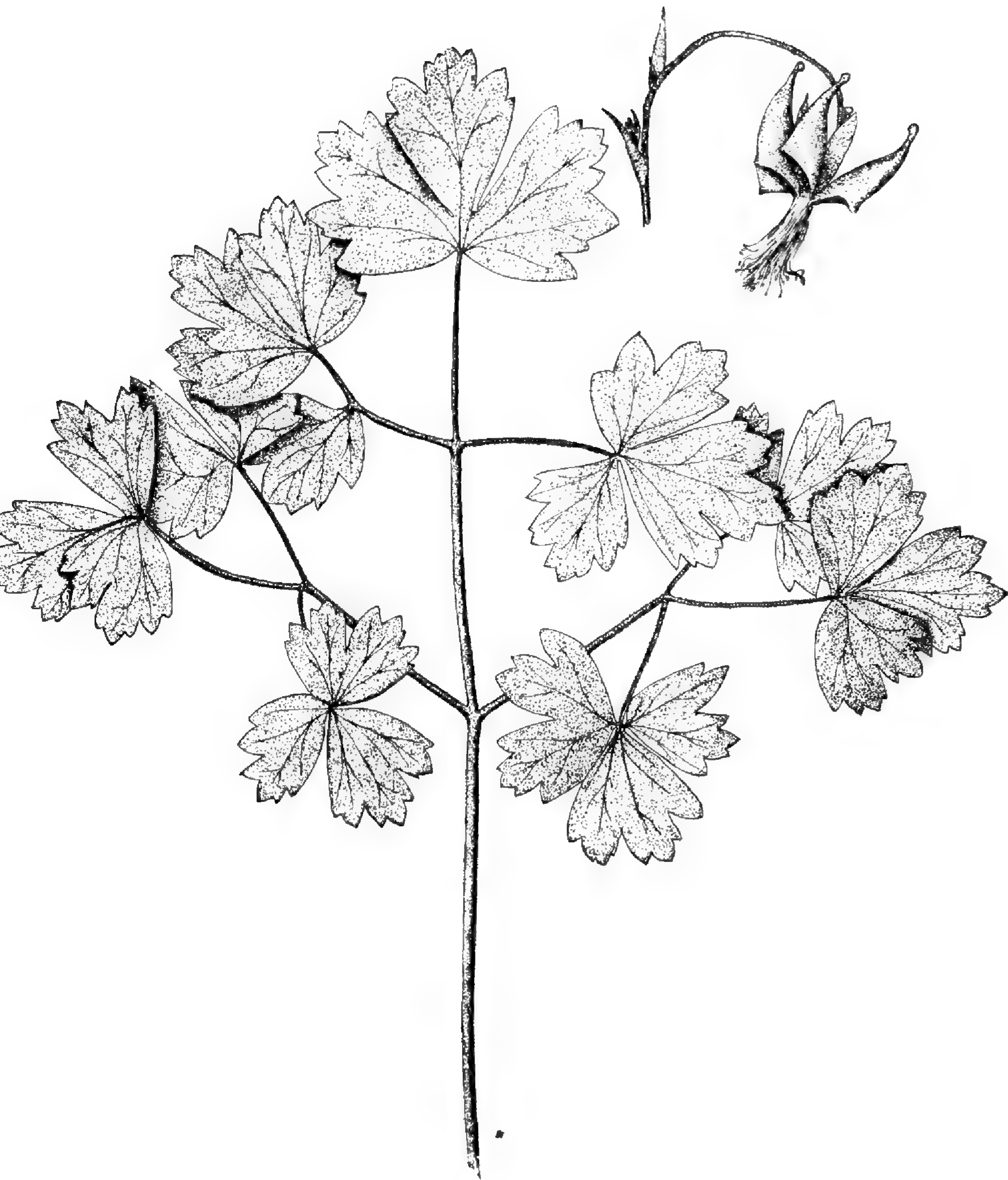
¹ Bot. Gaz. 8: 319. 1883.



AQUILEGIA FORMOSA CAELIFAX PAYSON.



AQUILEGIA WAWAWENSIS PAYSON.



AQUILEGIA TRACYI JEPSON.



AQUILEGIA ELEGANTULA GREENE.



AQUILEGIA PALLENS PAYSON.



AQUILEGIA LONGISSIMA A. GRAY.

THE ALLIES OF SELAGINELLA RUPESTRIS IN THE SOUTHEASTERN UNITED STATES.

By G. P. VAN ESELTINE.

INTRODUCTION.

The *rupestris* group of the genus *Selaginella*, in so far as it is represented in North America, has attracted the attention of several botanists, only two of whom, however, have attempted to analyze the group as a whole. Underwood published,¹ in 1898, a paper on "*Selaginella rupestris* and its allies," in which he called attention to the rich variety of forms, described 6 new species, and redescribed *S. rupestris* (L.) Spring, the type of the group, together with *S. tortipila* A. Br. Two years later Dr. Georg Hieronymus, of Berlin, published² a large number of new species of *Selaginella*, including 13 from North America previously involved in *S. rupestris*. In 1901, the same author gave a synopsis of the whole group,³ which, though very carefully prepared, was based unfortunately on a comparatively small number of specimens. With the exception of the redescription of *S. cinerascens* by A. A. Eaton, and a short paper by Doctor Underwood, describing 2 new species from the southeastern United States, there have been no further contributions to the knowledge of *S. rupestris* and its allies in North America.

It is apparent, however, from the diversity of the abundant material in American herbaria, that there are involved a number of additional species. The present series of papers, undertaken at the suggestion of Mr. William R. Maxon, is intended to survey the whole group of *Selaginella rupestris*, to amplify the older descriptions where it seems necessary, to describe such new species as appear, and to correlate all descriptions with as large an amount of material as practicable. In pursuance of the last-mentioned aim, the author has been greatly aided by the curators of the Gray Herbarium, and of the herbaria of the New York Botanical Garden and the Missouri Botanical Garden, who have generously lent for examination all

¹ Bull. Torrey Club 25: 125. 1898.

² Hedwigia 39: 290-320. 1900.

³ Engl. & Prantl, Pflanzenfam. 1⁴: 621-717. 1901.

the material in their keeping which comes within the scope of this paper.

The present instalment deals with the representatives of this group occurring in the Gulf Coastal Plain of the United States and the territory immediately adjacent to the northeast.

MORPHOLOGICAL NOTES.

In general appearance the plants of this group somewhat resemble small dwarfed forms of the club mosses (*Lycopodium* spp.). They are more or less cespitose in habit with erect, ascending, or repent, many-branched shoots covered with 6 to 13 rows of small sessile leaves.

The shoots or main stems are usually 5 to 25 mm. long (much longer in a few species); the primary branches are somewhat shorter than the shoots, but not otherwise different; the secondary branches generally average half as long as the primary branches; and the ultimate branchlets are merely short spurs, slightly enlarged at the tip and only a few millimeters in length. The branching appears to be dichotomous, but Campbell¹ states that it is really monopodial.

The rhizophores are leafless, stemlike structures, which arise exogenously from the stems and produce many capillary endogenous roots. They arise more numerous from the base of the shoots, but usually occur sparsely throughout their whole length.

The leaves, which are all alike, are small and sessile, and are usually provided with a suture (groove) in a median line on the dorsal side, cilia on the margins (also often on the edges of the dorsal suture), and a seta (awn) at the apex, although some of these characters are lacking in part of the species. As to length there is some diversity on the same plant, though other leaf characters are fairly constant. Descriptions of leaves throughout this paper refer to those of the primary shoots. The length of leaves is measured on the ventral side, from the point of attachment to the apex of the leaf proper, excluding the seta. It should be noted that cilia and setae are in all cases more or less deciduous.

The spikes (fruiting branches) are terminal and usually more or less 4-angled. The sporophylls are similar to the ordinary leaves but wider and often provided with short lobes or auricles at the base. The measurements for sporophylls are taken from those in the middle of the spike.

Each sporophyll bears either a megasporangium or a microsporangium. The position of these on the spike varies somewhat. On the erect or ascending plants the megasporangia usually occupy the lower rows of sporophylls, while the microsporangia occupy the upper and by far the larger number of sporophylls. In the repent or

¹ Mosses and ferns 522. 1905.

prostrate plants the megasporangia often occur only on the ventral side of the spike, while the microsporangia occur on the dorsal side.

The megasporangia, normally containing 4 megaspores, are irregularly spherical, bulging considerably over each megaspore. The megaspores are nearly spherical, but are slightly pyramidal on the commissural face, i. e., the side of contact with the other megaspores. This face usually bears 3 commissural ridges spreading at approximately equal angles from each other, beginning at the apex of the commissural side and extending to the base of the flattened portion. The ends of these ridges are sometimes connected by a raised ring. The surface may be either plain, somewhat rugose, tuberculate, or reticulate, wholly or in part. These irregularities on the surface of the megaspores are of considerable value in classification. It often happens that one megaspore of the tetrad develops at the expense of the other three, which are then much dwarfed. The stated size of megaspores in the following descriptions is that of an average normal megaspore.

The microsporangia are reniform, and contain several hundred microspores. These present much the same general appearance as the megaspores, but are exceedingly minute.

The writer's heartiest thanks are due to Miss Kathryn Steinle, of the Western High School, Washington, D. C., for the drawings of leaves, sporophylls, and megaspores.

DESCRIPTIONS OF SPECIES.

KEY TO THE SPECIES.

Megaspores smooth, at least on the outer face.

Stems (including leaves) up to 1 mm. thick; leaves without cilia in the dorsal suture, bearing a cluster of cilia on the long adnate base----- 2. *S. arenicola*.

Stems thicker; leaves usually bearing 4 to 10 cilia in the dorsal suture, without a cluster of cilia at the base.

Plants 7 to 12 cm. high; megaspores merely rugose on the commissural face.

Leaves rather lax, glaucous green; dorsal cilia of leaves as large as the marginal----- 3. *S. humifusa*.

Leaves closely appressed, darker green; dorsal cilia, when present, minute and usually confined to the basal portion of the dorsal suture ----- 4. *S. funiformis*.

Plants 3 to 6 cm. high; megaspores rugose-tuberculate on the commissural face----- 5. *S. acanthonota*.

Megaspores alveolate or rugose-reticulate or rugose-tuberculate.

Setæ tortuous; plants prostrate or ascending; megaspores rugose-tuberculate.

Plants prostrate, spreading; leaves 8-ranked----- 6. *S. tortipila*.

Plants ascending, densely cespitose; leaves 13-ranked----- 7. *S. sherwoodii*.

Setæ straight; megaspores alveolate or rugose-reticulate.

Plants erect; stems up to 1 mm. thick; megaspores rugose-reticulate..... 1. *S. riddellii*.

Plants ascending; stems thicker; megaspores alveolate..... 8. *S. rupestris*.

1. *Selaginella riddellii* Van Eseltine, sp. nov.

PLATE 15. FIGURE 63.

Plants erect or ascending, cespitose, 4 to 8 cm. (occasionally 12 cm.) high; rhizophores few, 1 to 5 cm. long (averaging 2 cm.), finely and copiously short-radicate; stems (including leaves) 0.7 to 1.2 mm. thick, rigid, branched at intervals of 6 to 12 mm.; branches few (2 to 4), 2.5 to 6 cm. long, with few branchlets, these simple, strictly ascending, up to 5 mm. long; leaves apparently 6-ranked, appressed, slightly imbricate, pale green when young, ochraceous to dark brown in age, thickish, flat or slightly concave on the upper surface,

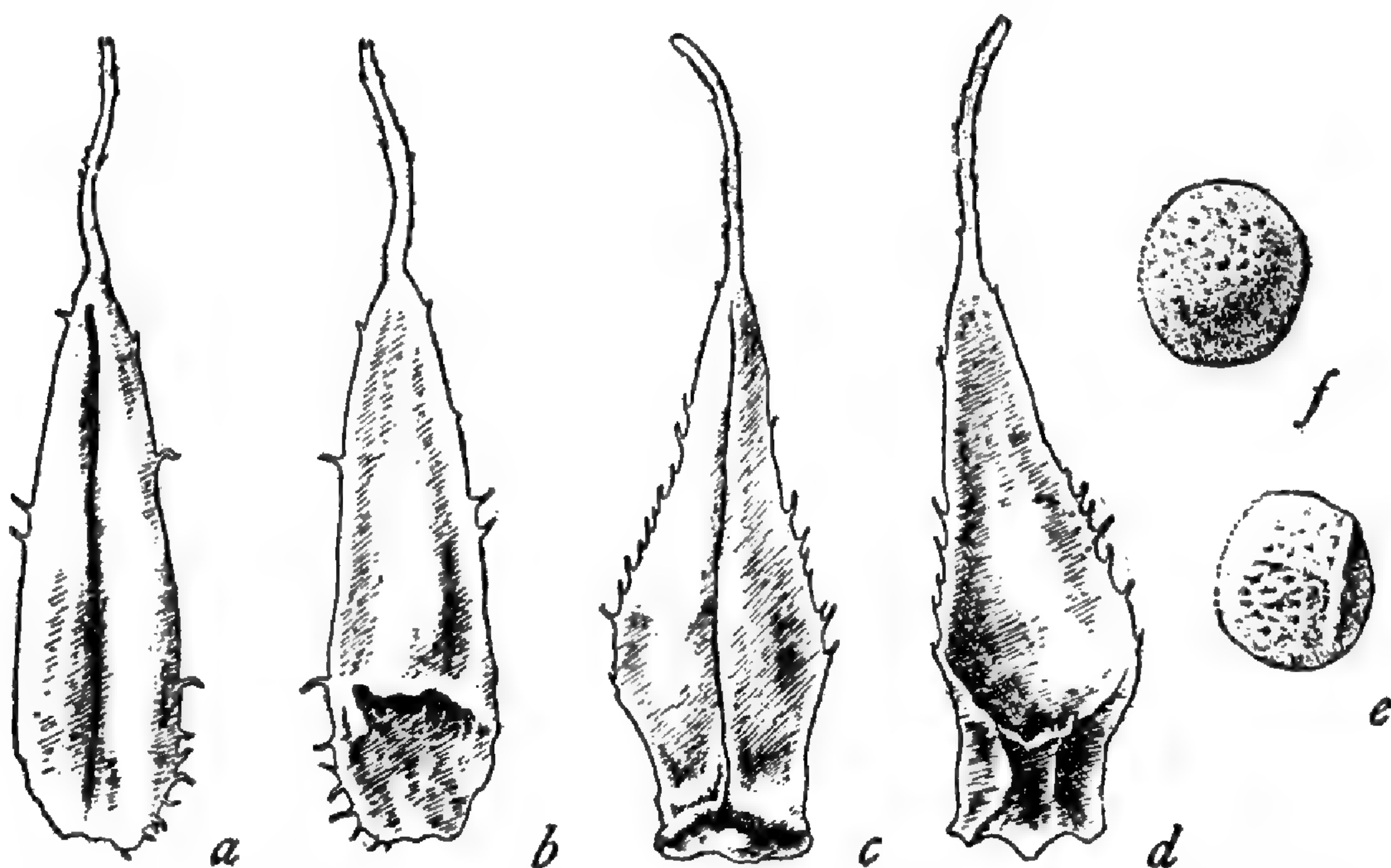


FIG. 63.—Details of *Selaginella riddellii*. a, Dorsal view of leaf; b, ventral view; c, dorsal view of sporophyll; d, ventral view; e, commissural face of megaspore; f, outer face. From the type specimen. Scale 30.

slightly convex on the lower, deeply sulcate dorsally in a median line up to the rather blunt apex, linear-deltoid to linear-lanceolate from a short obdeltoid base, minutely 4 to 8-ciliate on the margins; longest leaves 1.3 mm. long; cilia up to 0.06 mm. long, green, yellowish, or hyaline; setæ up to 0.6 mm. long, on the younger leaves white, on the older leaves reddish or yellow at the base, scabrous to spinulose-roughened.

Spikes nearly quadrangular, up to 2.5 cm. long; sporophylls up to 1.5 mm. long, 0.7 to 0.8 mm. wide just above the base, slightly elongate-triangular from an auriculate base (auricles rounded-triangular), minutely 12 to 18-ciliate on the margins; setæ and cilia similar to those of the stem leaves.

Megasporangia yellowish, 0.6 mm. in diameter; megaspores 0.45 mm. in diameter, yellowish, rugose-reticulate; microspores deep orange (deep yellow by transmitted light), up to 0.046 mm. in diameter.

Type in the U. S. National Herbarium, no. 690149, collected near Prairie View, Waller County, Texas, January 3, 1911, by F. W. Thurow (no. 7).

The following specimens have been examined:

TEXAS: Burnett County, *Reverchon* 1632 (N, M, Y).¹ Hudson Mountain, Gillespie County, *Jermy* 342 (N, M). Newton County, *Holmes & Fetherolf*, January, 1903 (N). Montgomery County, *Thurrow* 8 (N). Prairie View, Waller County, *Thurrow*, October 26, 1915 (N). Llano, *Lindheimer* 76 (M); *Plank* (Y). Marble Falls, *Plank* (Y). Austin, *Long*, March, 1900 (Y), and February, 1901 (Y). Localities wanting, *Drummond* 352 (Y); *Riddell* 16 (Y).

DISTRIBUTION: Central and eastern Texas. probably through southern Louisiana.

The rugose-reticulate megaspores differentiate this plant from all others of the southeastern United States, while the very slender, erect shoots are in rather marked contrast with any of the other Texan and New Mexican species. *Selaginella rupincola*, with which this species might possibly be confused, is a larger plant, with longer setæ, thicker stems, and megaspores with a raised ring circumscribing the ends of the commissural ridges.

There is a brief manuscript description of this species (under *Lycopodium*) by Riddell in the Gray Herbarium.

EXPLANATION OF PLATE 15.—Type specimen of *Selaginella riddellii*. Natural size.

2. *Selaginella arenicola* Underw. Bull. Torrey Club 25: 511. 1898.

PLATES 16, 17. FIGURE 64.

Selaginella arenaria Underw. Bull. Torrey Club 25: 129. 1898, not Baker, 1883.

Plants erect, fasciculate, 5 to 10 cm. high, somewhat rigid; rhizophores abundant, arising only from the base of the shoots; stems (including leaves) up to 1 mm. thick, rigid, freely branched at intervals of 7 to 10 mm.; primary branches few (3 to 5), 4 to 8 cm. long, with few short branchlets, these 5 to 10 mm. long, simple, strictly ascending, incurved; leaves 6-ranked, appressed, slightly imbricate, in the younger stages glaucous green, in age becoming cinereous brown, thickish, papillose-roughened, flat above, slightly convex beneath, deeply sulcate dorsally in a median line up to the apex, linear-deltoid from a long decurrent base, minutely 7 to 14-ciliate on the margin, bearing a clump of cilia on the decurrent base; longest leaves 1.2 mm. long, about 0.3 mm. wide at the base; cilia 0.03 to 0.06 mm. long; setæ up to 0.8 mm. long, 0.03 to 0.06 mm. thick, white with yellowish base, spinulose-serrulate throughout.

Spikes terminal on the shoots and upper branches, quadrangular, 1.5 to 2 cm. long; sporophylls elongate-triangular from an auriculate base (auricles broadly rounded-triangular) acute, in the younger stages glaucous green, in age becoming pale brown, somewhat cymbiform, about 1.2 mm. long, 0.66 mm. wide at the base, 15 to 25-ciliate on the margin, deltoid.

Megasporangia in the axils of the lower sporophylls, 0.6 mm. in diameter; megaspores crustaceous, punctate on the commissural side, irregularly and minutely punctulate on the opposite side, chalk-white, 0.4 mm. in diameter; microsporangia in the axils of the upper sporophylls, flattened, reniform, the widest diameter 0.6 mm.; microspores red to orange, the widest diameter 0.036 mm.

¹ Capitals in parentheses designate the herbarium in which the specimen examined is deposited, as follows: (N), U. S. National Herbarium; (G), Gray Herbarium of Harvard University; (Y), herbarium of the New York Botanical Garden; (M), herbarium of the Missouri Botanical Garden.

The type, in the herbarium of the New York Botanical Garden, was collected near Eustis, Lake County, Florida, January 14, 1891, by L. M. Underwood (no. 1355 in part).

Other collections of this species are:

GEORGIA: Near Bainbridge, *Curtiss* 6714 (N, G, Y). Near Pendleton Creek, about 3 miles south of Ochopee, Tatnall County, *Harper* 1860 (N, M, Y). Near Ochopee River, west of Reidsville, Tatnall County, *Harper* 1854 (N, G, M, Y). Near Chattahoochee River, Muscogee County, exposed granite rocks, *Harper* 1800 (N, G, M). Albany, *Tracy* 3510 (M).

FLORIDA: Near Chattahoochee, arid sandy ridges, *Curtiss* (N). About 2½ miles south of Grandin, Putnam County, high pine land near edge of scrub hammock, *Harper* 6 (N). Orange County, *Meislahn* 138 (N). Gadsden County, *Chapman* (Y). Eustis, Lake County, *Underwood* 1355a (Y). Claremont, *Williamson* (Y). Braidentown, in "marigold" and oak scrubs, on loose white sand, *Combs* (N).

DISTRIBUTION: Dry sandy ground or rock waste, central and northern Florida and southern Georgia.

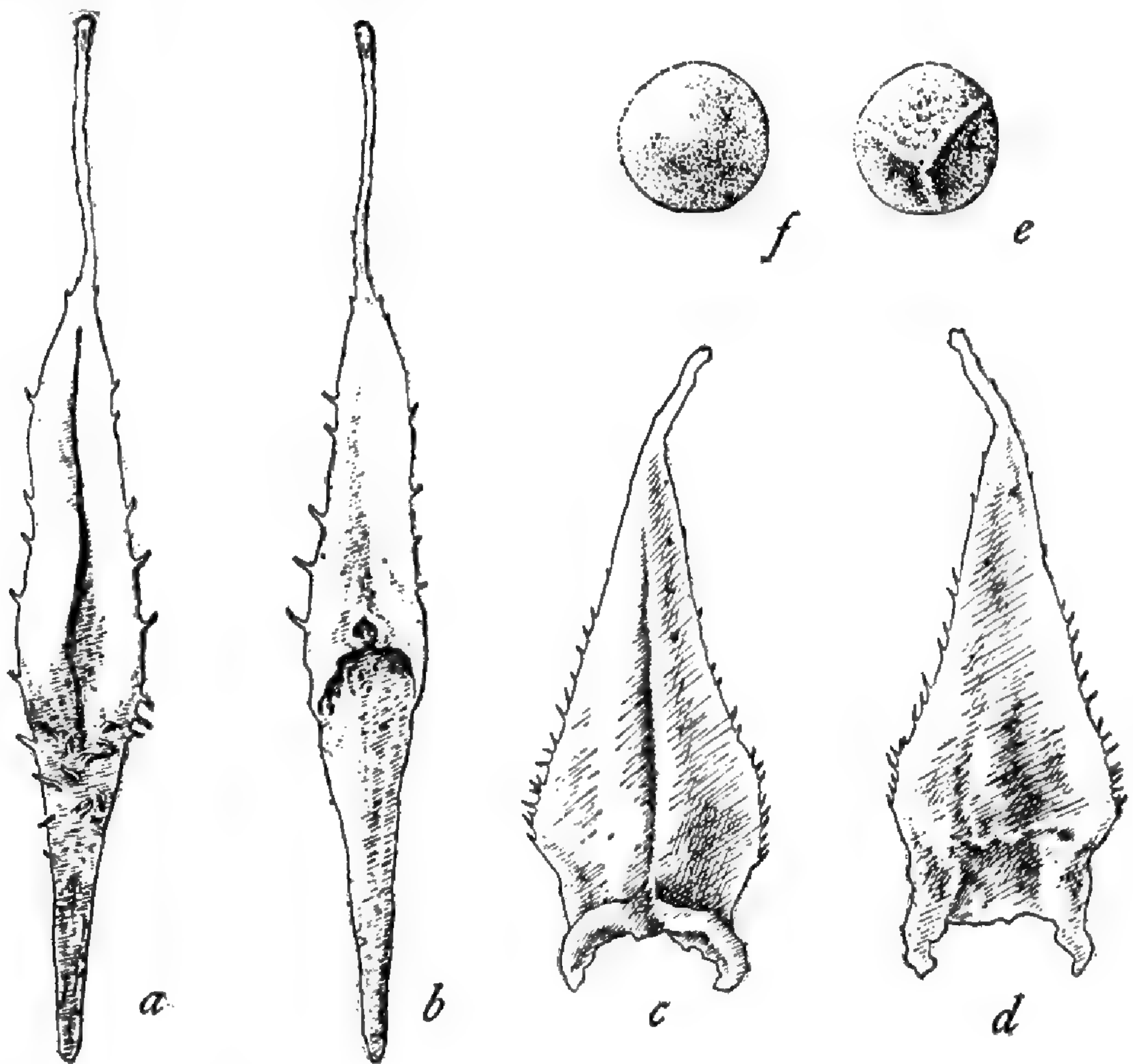


FIG. 64.—Details of *Selaginella arenicola*. *a*, Dorsal view of leaf; *b*, ventral view; *c*, dorsal view of sporophyll; *d*, ventral view; *e*, commissural face of megaspore; *f*, outer face. From the type specimen. Scale 30.

On the type sheet of *S. arenicola* in the herbarium of the New York Botanical Garden there are 10 pieces of *Selaginella*. Six of these are obviously one species, probably portions of the same plant, and the other four are portions of a plant or plants entirely distinct in several respects. These differences are taken up at length following the description of the second species represented.

It is the plant with more slender stems and with leaves bearing no cilia in the dorsal suture that must be taken as the type of *S. arenicola*, since Underwood, in his description, emphasizes the fact that the plant is "slender" and makes no mention of the dorsal cilia, while he subsequently used the presence of these as a distinguishing mark of *S. acanthonota*. Of the other two specimens cited by Underwood in his descriptions of the species, one (Gadsden County, Florida, *Chapman*, in 1840) is true *S. arenicola*; and the other (collected in the vicinity of Eustis, Lake County, Florida, July 16-31, 1894, by Nash, no. 1449) belongs to the other species.

Selaginella arenicola is readily distinguished from any other species by its nearly smooth megaspores, long adnate leaf base, and extremely slender stems. Harper's no. 1860 is peculiar in having a somewhat laxer habit and more spreading leaves than most collections of this species.

EXPLANATION OF PLATES 16, 17.—*Selaginella arenicola*. Pl. 16, the type specimen; Pl. 17, specimen collected near Grandin, Putnam County, Florida, *Harper* 6, U. S. Nat. Herb. no. 513489. Both natural size.

3. *Selaginella humifusa* Van Eseltine, sp. nov.

PLATE 18. FIGURE 65.

Plants ascending, densely cespitose, 5 to 7 cm. high; rhizophores abundant, arising only from the base of the shoots; stems (including leaves) up to 2 mm.

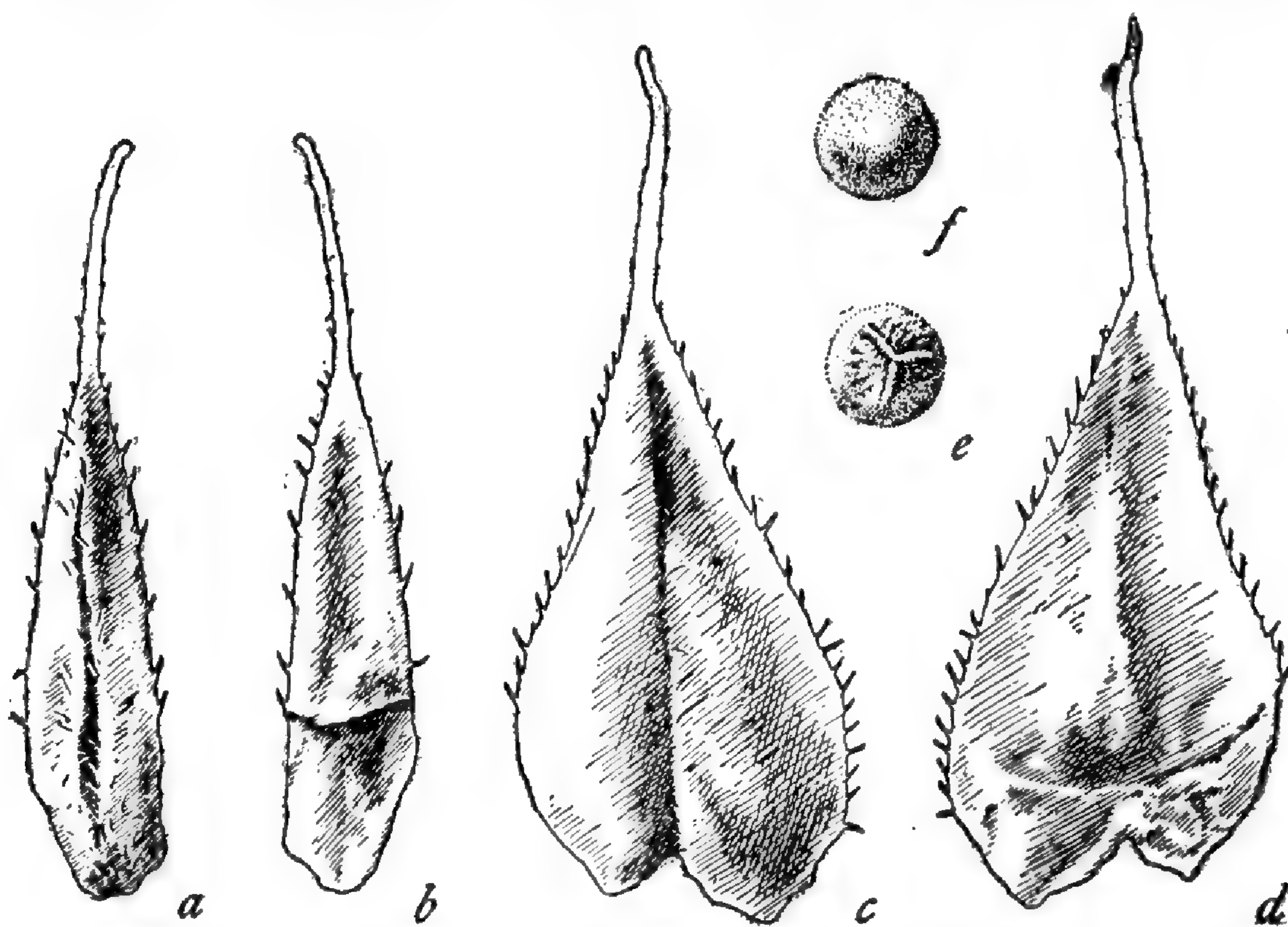


FIG. 65.—Details of *Selaginella humifusa*. a, Dorsal view of leaf; b, ventral view; c, dorsal view of sporophyll; d, ventral view; e, commissural face of megaspore; f, outer face. From the type specimen. Scale 30.

thick, rather lax, freely repeatedly branching at intervals of 3 to 6 mm.; primary branches abundant, 3 to 6 cm. long, with abundant short branchlets 5 to 20 mm. long, these with still smaller branchlets; ultimate branchlets up to 5 mm. long, simple, divaricate; leaves 8 to 10-ranked, imbricate, slightly appressed, in the younger stages pale green, in age becoming cinereous brown, thickish, chartaceous, minutely papillose-roughened, flat above, slightly convex beneath, sulcate dorsally in a median line up to the apex, narrowly deltoid from a short obdeltoid base, minutely 8 to 12-ciliate on the margins, bearing 5

to 10 cilia on the edges of the dorsal suture; longest leaves 1.5 mm. long, 0.3 mm. wide at the base; cilia 0.045 to 0.076 mm. long; setæ deciduous, up to 1 mm. long, 0.034 to 0.068 mm. thick, white, spinulose-roughened.

Spikes terminal, nearly quadrangular, up to 2 cm. long, 1 mm. thick; sporophylls 1.75 mm. long, 1 mm. wide, deltoid, auriculate at base, narrowly sulcate dorsally in a median line up to the ciliate setigerous apex, 15 to 25-ciliate on the margins, occasionally very minutely ciliate on the base, with 4 to 10 cilia on the edges of the dorsal suture; setæ and cilia similar to those of stem leaves; auricles rounded-deltoid, 0.2 mm. wide.

Megasporangia reddish yellow, 0.7 mm. in widest diameter; megaspores crustaceous, whitish, more or less minutely punctate, rougher on the commissural side, 0.3 to 0.35 mm. in diameter; microsporangia 0.6 mm. in widest diameter, reniform, orange or brownish orange; microspores abundant, bright orange, 0.03 mm. in diameter.

Type in the U. S. National Herbarium, no. 228293, collected in the vicinity of Eustis, Lake County, Florida, July 16-31, 1894, by George V. Nash (no. 1449).

Other collections of this species are:

FLORIDA: Dry sandy soil, Lake County, *Nash* 1449 (G, M, Y). Sanford, Orange County, September, 1900, *Rapp* (N). Sandy pine woods, Alapattah, Dade County, *Eaton* (N, G).

DISTRIBUTION: Central and southern Florida.

Selaginella humifusa, which is the species confused by Underwood with his *S. arenicola*, differs markedly from that species in several respects. Whereas the leaves of each are of nearly the same length on the inner surface from the point of attachment to the tip, the long basal portion of the leaves of *S. arenicola* makes them appear on the outer face or dorsal side from half as long again to twice as long as those of *S. humifusa*. The basal portion of the leaves of *S. humifusa* may or may not have a few very minute cilia upon it, but this portion of the leaves of *S. arenicola* usually has a distinct clump of cilia quite as long as the marginal ones. *Selaginella humifusa* has cilia along the edges of the dorsal suture, and *S. arenicola* never has them. It must be borne in mind, however, that these cilia are, like the marginal ones and the setæ, more or less deciduous, and are not to be found on every leaf. The leaves of *S. humifusa* are apparently 8 to 10-ranked and those of *S. arenicola* apparently never more than 6-ranked. The latter species is less loosely tufted than the former, as also much more slender.

This species differs from its closest ally, *S. funiformis*, in the following characters: The leaves are thinner and flatter, not so closely appressed, and (in drying) of a much lighter green color. The dorsal cilia are large and rather abundant in *S. humifusa* and exceedingly minute or absent in *S. funiformis*. The spores of the latter are much rougher than those of *S. humifusa*. The stiff, cordlike appearance of *S. funiformis* furnishes a rather obvious distinguishing character, as opposed to the softer and more lax appearance of *S. humifusa*.

EXPLANATION OF PLATE 18.—Type specimen of *Selaginella humifusa*. Natural size.

4. *Selaginella funiformis* Van Eseltine, Proc. Biol. Soc. Washington 30: 161. 1917. PLATE 19. FIGURE 66.

Plants erect, caespitose, rigid, up to 12 cm. high; rhizophores abundant at the base of shoots, sparse along the older portions of the stem; stems (including leaves) up to 1.2 mm. thick, rigid, sparsely branched at intervals of 7 to 10 mm., primary branches few, 5 to 8 cm. long, these bearing few secondary branches (up to 20 mm. long); ultimate branchlets occurring throughout, up to 5 mm. long, simple, closely ascending; leaves 8 to 12-ranked, very closely appressed, imbricate, in the younger stages olive-green, in age becoming dull brown, thick-

ish, chartaceous, slightly concave above, convex beneath, narrowly sulcate dorsally in a median line up to the acute apex, narrowly deltoid from a short broadly obdeltoid base, 6 to 10-ciliate on the margins, occasionally minutely 4 to 8-ciliate along the edges of the dorsal suture; longest leaves 1.25 mm. long, 0.4 mm. wide at the base; cilia 0.03 to 0.06 mm. long; setæ white with a reddish base, scabrous, up to 1 mm. long.

Spikes nearly quadrangular, up to 15 mm. long, 1 mm. thick; sporophylls 1.5 mm. long, 0.8 mm. wide at the base, narrowly sulcate dorsally in a median line up to the acute apex, auriculate, minutely 10 to 20-ciliate on the margin, occasionally 4 to 8-ciliate on the edges of the dorsal suture near the base; auricles broadly obdeltoid, ciliate; cilia more minute and setæ slightly shorter than on the stem leaves.

Megasporangia yellowish, 0.6 mm. in widest diameter; megaspores rugose on the commissural side, nearly smooth on the opposite side, 0.3 mm. in diameter; microsporangia 0.6 mm. in widest diameter, reniform, orange or brownish; microspores abundant, bright orange, 0.03 mm. in diameter.

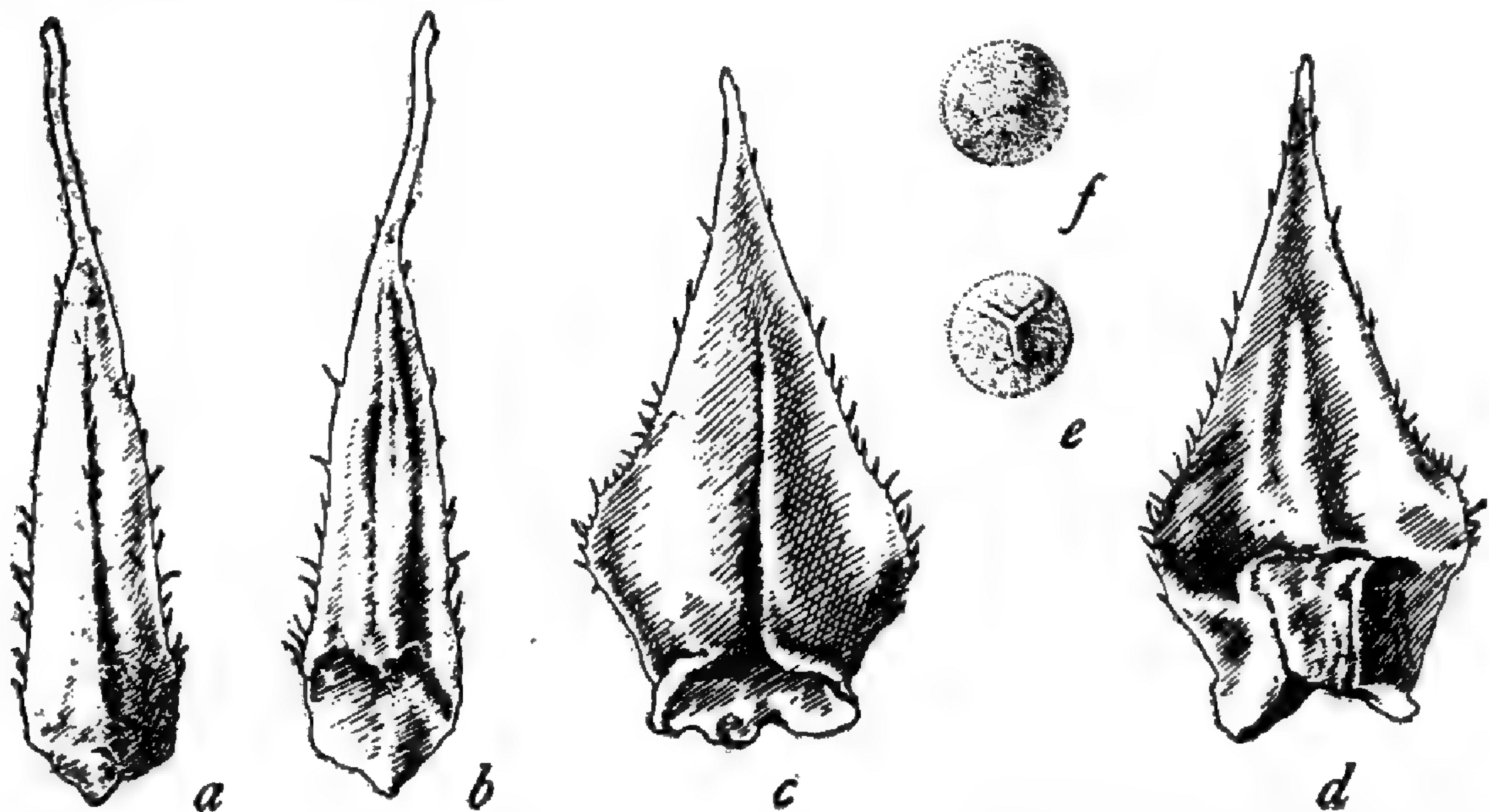


FIG. 66.—Details of *Selaginella funiformis*. a, Dorsal view of leaf; b, ventral view; c, dorsal view of sporophyll; d, ventral view; e, commissural face of megaspore; f, outer face. From the type specimen. Scale 30.

Type in the U. S. National Herbarium, no. 723895, collected on hillocks of loose sand in shade of scrubby oaks near Carrabelle, Florida, March 15, 1898, by Charles Mohr.

The following specimens have been examined:

FLORIDA: Carrabelle, Mohr, March 10, 1898 (N), and March 14, 1898 (N); "Chapman" (Biltmore distribution, no. 3432b) (N, G, Y); "Chapman" (without number) (M). Indian River, Palmer (M, G). Palatka, Hasbrouck (N). Fort Lauderdale, Small & Carter 1013 (G, Y); Small, Carter & Small 3349 (Y); Small & Wilson 1762 (Y). Clearwater, Huger (Y).

DISTRIBUTION: Sand dunes and barrens, throughout Florida.

This species is closely allied to *S. humifusa*, but differs in the points noted under that species. Its next closest ally, *S. arenicola*, differs in the long-adnate base of the leaf, smoother megaspores, fewer ranks of leaves, and correspondingly smaller stems. The extremely closely appressed leaves give the stem an appearance not unlike that of stiff cord.

EXPLANATION OF PLATE 19.—Type specimen of *Selaginella funiformis*. Natural size.

5. *Selaginella acanthonota* Underw. Torrey 2: 172. 1902.

PLATE 20. FIGURE 67.

Selaginella rupestris acanthonota Clute, Fern Allies 142, 264. 1905.

Plants cespitose, ascending, up to 5 cm. high; rhizophores abundant throughout; stems (including leaves) up to 2 mm. thick, somewhat rigid, densely repeatedly branched at intervals of 3 to 7 mm.; primary branches 3 to 5 cm. long, similar to shoots; ultimate branchlets up to 7 mm. long, simple, closely ascending; leaves 8 to 10-ranked, imbricate slightly over half their length, appressed, in the younger stages pale green, in age becoming reddish brown, thickish, chartaceous, flat above, slightly convex beneath, sulcate dorsally in a median line up to the apex, 8 to 12-ciliate on the margins, 4 to 8-ciliate along the edges of the dorsal suture, narrowly deltoid from a short obdeltoid base; longest leaves 1.6 mm. long, 0.4 mm. wide at the base; cilia 0.042 to 0.051 mm. long; setæ deciduous, up to 1 mm. long, 0.034 to 0.068 mm. thick, white with reddish base, minutely spinulose.

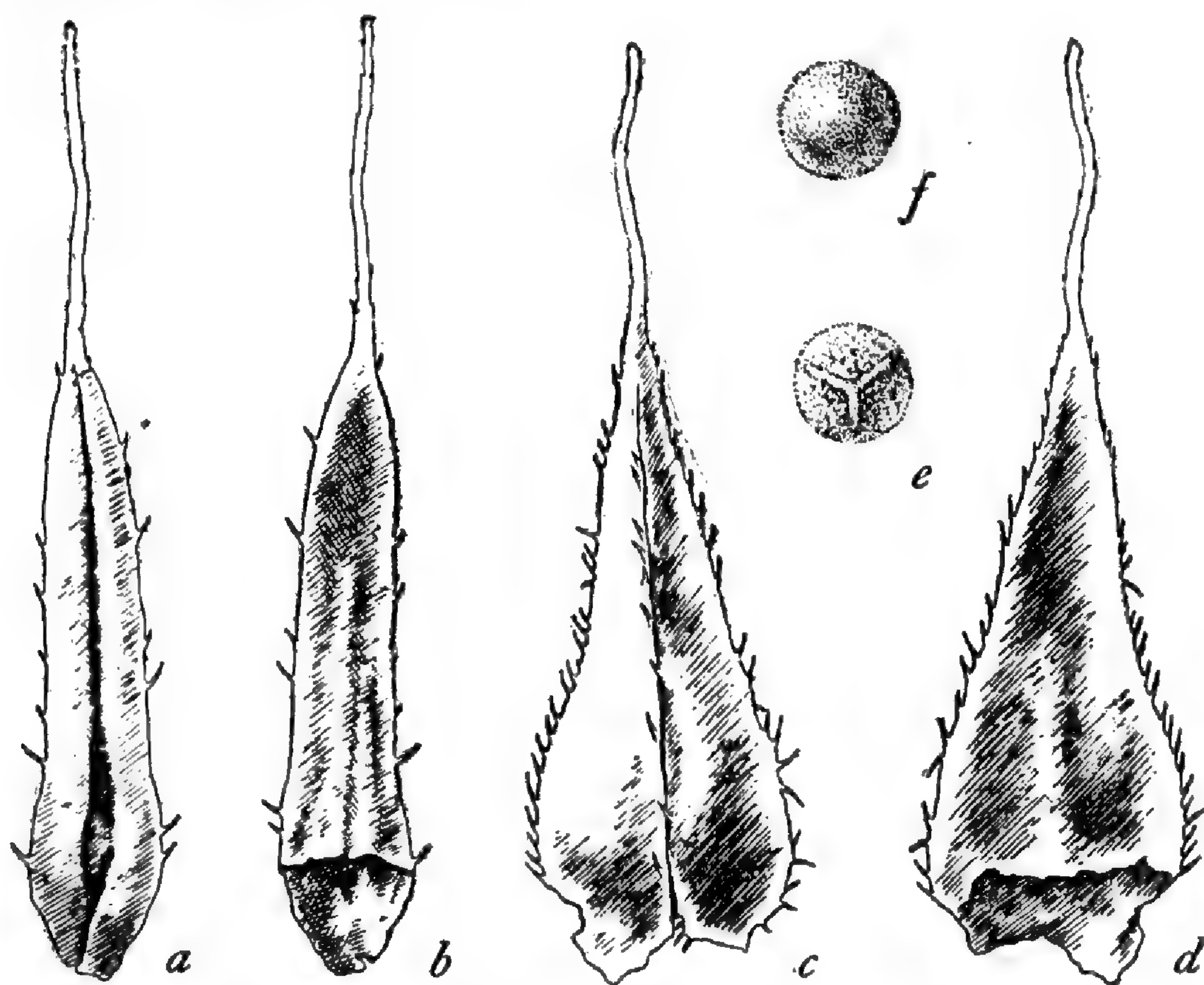


FIG. 67.—Details of *Selaginella acanthonota*. a, Dorsal view of leaf; b, ventral view; c, dorsal view of sporophyll; d, ventral view; e, commissural face of megaspore; f, outer face. From the type specimen. Scale 30.

Spikes terminal, quadrangular, up to 3 cm. long, 1.5 to 2 mm. thick; sporophylls up to 2 mm. long, 0.8 mm. wide at the base, deltoid, 20 to 25-ciliate on the margins, minutely 10 to 15-ciliate on the edges of the dorsal suture; setæ about two-thirds as long as those of stem leaves; cilia much more minute.

Megasporangia pale yellow, 0.6 mm. in widest diameter; megaspores white, 0.28 mm. in diameter, tuberculate-rugose on the commissural side, nearly smooth on the opposite side; microsporangia 0.5 mm. in diameter, reniform, pale orange; microspores pale orange, 0.05 mm. in diameter.

The type, in the herbarium of the New York Botanical Garden, was collected by C. L. Williamson in pine barrens near Wilmington, North Carolina, July, 1892.

The following specimens have been examined:

FLORIDA: Scrub between Narcoosie and Runnymede, Osceola County, *Harper* 10 (N, M). Dry pine barrens at base of Tabletop Hill, northwest of West Apopka, Lake County, *Harper* 16 (N, G, M). Scrub about 3 miles east of Tavares, Lake County, *Harper* 17 (N, M). Palma Sola, *Tracy* 7554 (N, M, G).

GEORGIA: Sand hills of Ochopee River near Reidsville, Tatnall County, *Harper* 1852 (N, G, M). Dry pine barrens east of Arabi, Dooly County, on rocks, *Harper* 1957 (N, G, M). Sand hills of the Little Ocmulgee River, Montgomery County, *Harper* 1987 (N, G, M). Near Harrison, on Altamaha grit, *Harper* (N, Y).

NORTH CAROLINA: East of Wilmington, in dry sand, *Bartram* (G), *Chase* (N).

DISTRIBUTION: Central Florida to North Carolina, along the Coastal Plain.

Williamson in a letter to Underwood—the letter now attached to the type sheet in the herbarium of the New York Botanical Garden—states that this species “grew in the white sand of the open sand barrens in circular clumps a foot or more in diameter, that were generally almost covered by the drifting sand.” The specimen of *Harper*’s no. 1987 (with photograph) in the Gray Herbarium shows the habit very well.

This species differs noticeably from *S. humifusa*, to which it is closely related, in its dwarfish aspect, as well as in its much more rugose spores, and its more minute dorsal cilia, those of *S. acanthonota* being extremely fine, while those of *S. humifusa* are quite as large and prominent as are the marginal ones. The dwarf habit and more strongly rugose spores also serve to distinguish it from *S. funiformis*. It is typically more lax than *S. funiformis*, but there is a very considerable variation in that respect. *Selaginella acanthonota* seems to be the most variable species in the group, exclusive, perhaps, of *S. rupestris*.

Underwood in his notes on *S. acanthonota* says that it is related to *S. rupestris*. The lack of definite reticulation on the megaspores, as well as the more stiffly ascending or semierect habit and the shorter leaves with dorsal cilia, shows it to be much more closely related to *S. humifusa* and the other southern species.

EXPLANATION OF PLATE 20.—Type specimen of *Selaginella acanthonota*. Natural size.

6. *Selaginella tortipila* A Br. Ann. Sci. Nat. V. 3: 2. 1865.

PLATE 21. FIGURE 68.

Selaginella rupestris tortipila Underw. Native Ferns ed. 4. 140. 1893.

Plants prostrate, loosely fasciculate, 20 to 25 cm. long, producing rhizophores at the base of the shoots, rarely elsewhere; stems (including leaves) up to 1.25 mm. thick, flexuous, loosely repeatedly branched at intervals of 7 to 25 mm.; larger branches similar to the primary shoots; ultimate branchlets up to 20 mm. long, slightly thicker than the shoots; leaves 8-ranked, imbricate, closely appressed on the shoots and branches, more lax on the ultimate branchlets, in the younger stages pale glaucous green, in age becoming ochraceous to cinereous brown, chartaceous, thickish, slightly concave above, strongly convex beneath, narrowly sulcate dorsally nearly to the thick blunt apex, lanceolate from a long decurrent base, minutely 3 to 8-ciliate on the margins, abruptly setigerous at the apex; longest leaves 2 mm. long, 0.6 mm. wide at the base; cilia up to 0.045 mm. long, hyaline, deciduous; setæ fibriform, minutely spinulose, extremely tortuous, ochraceous to hyaline, up to 0.7 mm. long.

Spikes inconspicuous, not more than 5 mm. long; sporophylls ovate-lanceolate, cymbiform, 0.9 mm. wide above the base, minutely 6 to 12-ciliate on the margins, otherwise similar to the stem leaves.

Megasporangia 0.6 mm. in diameter, arranged on the ventral side of the spike; megaspores subrugose-tuberculate, yellow, 0.36 mm. in diameter; microsporangia arranged on the dorsal side of the spike, reniform, flattened, 0.75 mm. in diameter; microspores 0.04 mm. in diameter.

There is a duplicate of the type in the herbarium of the New York Botanical Garden: "In locis humidis montium ad Broad River, Carolina Sept. legit Rugel, July, 1841."



FIG. 68.—Details of *Selaginella tortipila*. *a*, Dorsal view of leaf; *b*, ventral view; *c*, dorsal view of sporophyll; *d*, ventral view; *e*, commissural face of megaspore; *f*, outer face. From specimen collected at Caesars Head, South Carolina, August 6, 1881, by John Donnell Smith; U. S. Nat. Herb., no. 154689. Scale 30.

Other specimens examined are:

SOUTH CAROLINA: Exposed rocks, Caesars Head, Green County, alt. 1,350 meters, *Smith* (N, G, Y); *Engelmann* (M); *Redfield* (M). Table Rock, *Gray & Carey* (G). Without definite locality, *Ravenel* (G).

DISTRIBUTION: On granite (?) rocks, mountains of South Carolina.

The characters noted in the key serve as ready marks of distinction between this species and the next. The relatively thick leaves and tortuous awns effectually distinguish this plant from all other eastern species.

EXPLANATION OF PLATE 21.—*Selaginella tortipila*. Specimen collected on Caesars Head, South Carolina, Sept. 2, 1876, by Engelmann; Herb. Missouri Bot. Gard., no. 46797. Natural size.

7. *Selaginella sherwoodii* Underw. Torrey 2: 172. 1902.*Selaginella rupestris sherwoodii* Clute, Fern Allies 142, 264. 1905.

PLATE 22. FIGURE 69.

Plants ascending, densely cespitose, somewhat rigid, 8 to 12 cm. high, producing rhizophores only at the base of the shoots; stems (including leaves) 1.5 to 1.75 mm. thick, densely repeatedly branched at intervals of scarcely 10 mm. between the larger branches, and of scarcely 5 mm. between the ultimate branchlets; lower branches loosely ascending, similar to the shoots but shorter; ultimate branchlets simple, less than 5 mm. long, as thick as the primary shoots; leaves about 13-ranked, closely appressed, imbricate, in younger stages pale olivaceous to glaucous green, in age becoming ochraceous to dark cinereous brown, chartaceous, thickish, slightly concave above with a slight median ridge in older leaves, strongly convex beneath, either not channeled or shallowly sulcate dorsally in the lower two-thirds, narrowly elliptic-ovate from a long decurrent base, abruptly setigerous at the blunt semiterete apex, minutely ciliate

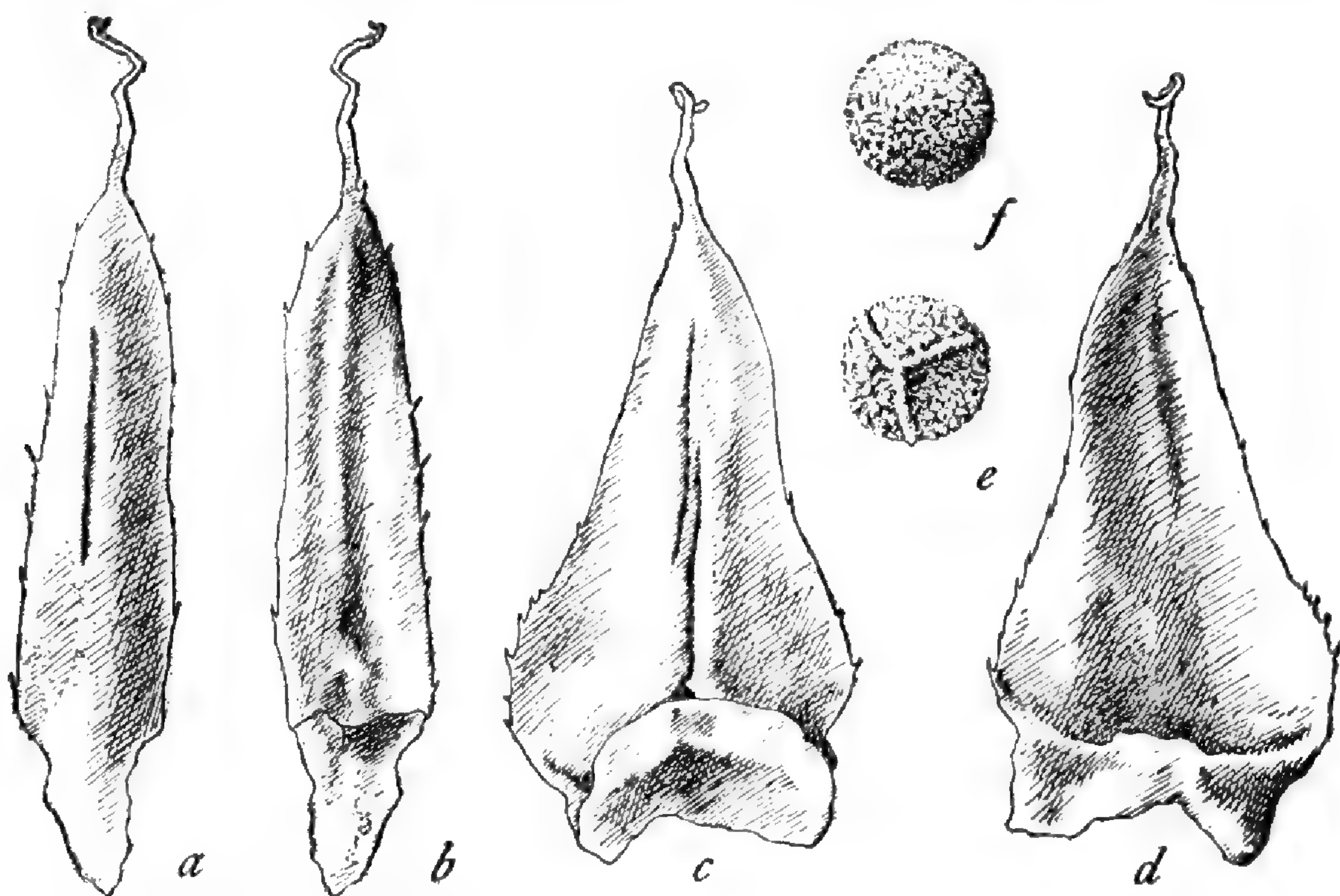


FIG. 69.—Details of *Selaginella sherwoodii*. *a*, Dorsal view of leaf; *b*, ventral view; *c*, dorsal view of sporophyll; *d*, ventral view; *e*, commissural face of megaspore; *f*, outer face. From specimen collected on Satulah Mountain, near Highlands, North Carolina, August 30, 1882, by John Donnell Smith; U. S. Nat. Herb., no. 834949. Scale 30.

on the margins; largest leaves 1.5 mm. long, 0.35 mm. wide at the base; setæ fibriform, extremely tortuous (in dried specimens), minutely spinulose, white, up to 1 mm. long; cilia 8 to 15 on each side of the leaf, 0.03 mm. long.

Spikes terminal, inconspicuous, less than 5 mm. long; sporophylls similar to the leaves but wider at the base and more deeply sulcate.

Megasporangia arranged on the ventral side of the spike, yellowish, the widest diameter 0.6 mm.; megaspores tuberculate-rugose, yellow, 0.4 mm. in diameter; microsporangia arranged on the dorsal side of the spike, reniform, flattened, 0.6 mm. in widest diameter; microspores red to orange, 0.046 mm. in diameter.

The type, in the herbarium of the New York Botanical Garden, was collected near Highlands, Macon County, North Carolina, by W. L. Sherwood.

The following specimens have been examined:

NORTH CAROLINA: Summit of Satulah Mountain, near Highlands, Macon County, alt. 1,500 meters, on exposed rocks, *Smith* (N, M, G). Highlands, *Sherwood* in 1901 (Y), and in 1902 (Y). Hendersonville, *Huger* (Y).

DISTRIBUTION: Mountains of North Carolina.

The many-ranked leaves and densely cespitose habit of *S. sherwoodii* serve as very obvious distinguishing characters. The tortuous setae and the tuberculate megaspores also form important distinctions.

The closely appressed, shallowly sulcate, thick leaves are so wholly unlike the longer, flatter, more lax, deeply sulcate leaves of *S. rupestris* that there is little likelihood of confusion. *Selaginella acanthonota* does not, so far as known, reach the altitude of this or the next species, but its more erect habit, its rigid setae, and the dorso-ventral arrangement of its spores would, in any case, serve immediately to distinguish it.

EXPLANATION OF PLATE 22.—*Selaginella sherwoodii*. Specimen collected on Satulah Mountain, near Highlands, North Carolina, August 30, 1882, by John Donnell Smith; U. S. Nat. Herb., no. 834049. Natural size.

8. *Selaginella rupestris* (L.) Spring in Mart. Fl. Bras. 1^r: 118. 1840.

FIGURE 70.

Lycopodium rupestre L. Sp. Pl. 1101. 1753.

This species, while not endemic to the southeast, as are the other plants discussed, grows along the mountains well down into Georgia. Its alveolate-reticulate megaspores form a ready distinction. It shows several marked

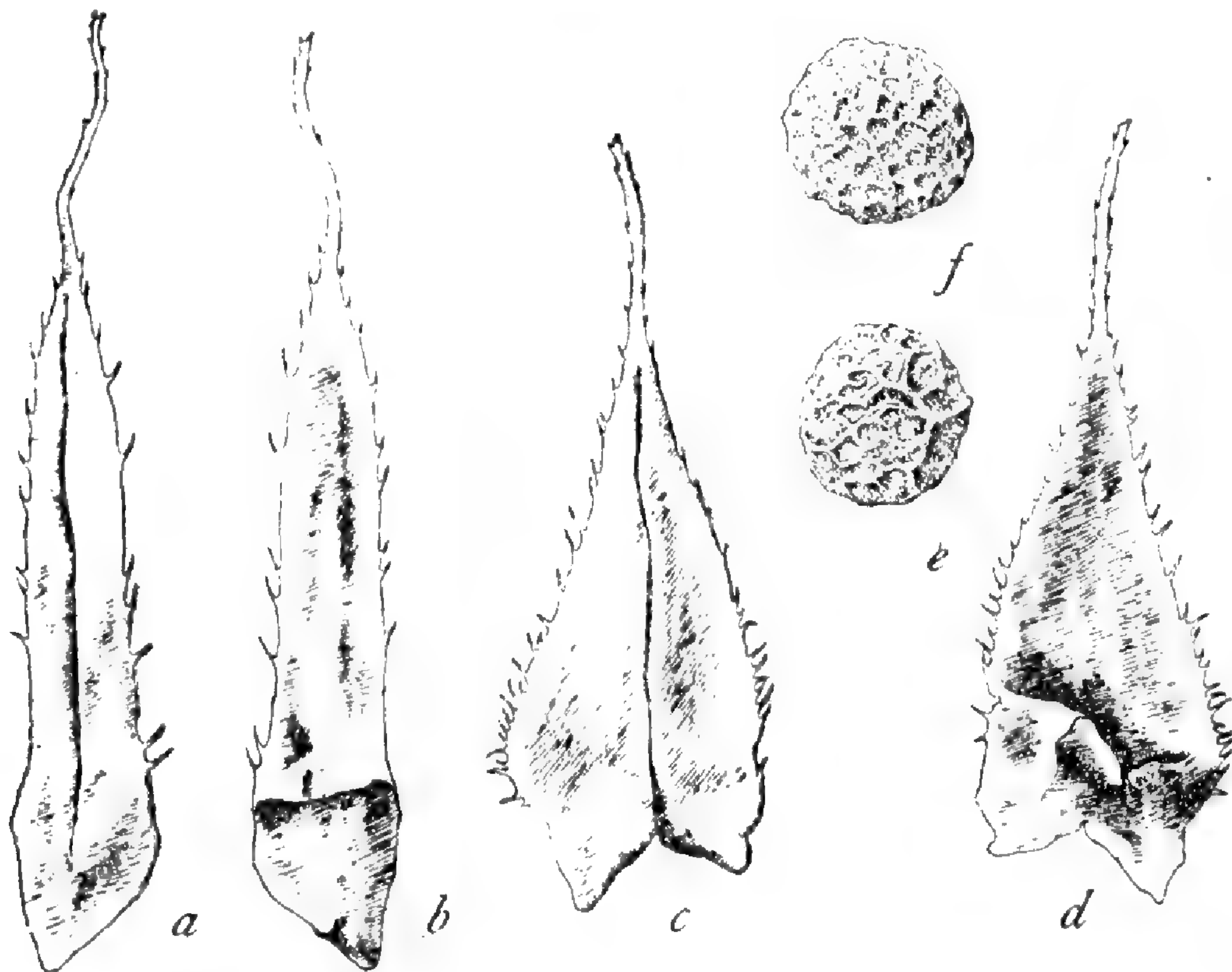
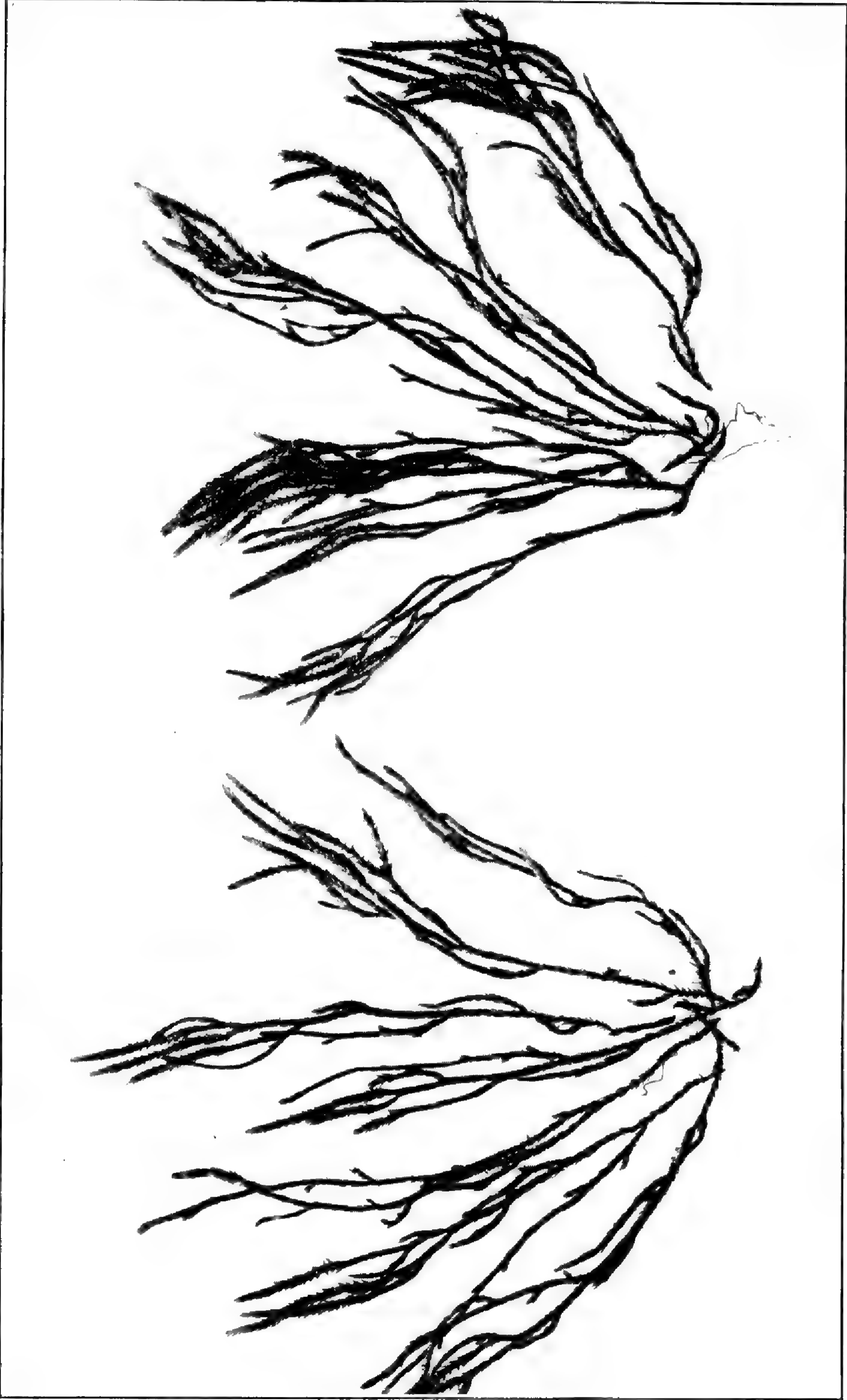
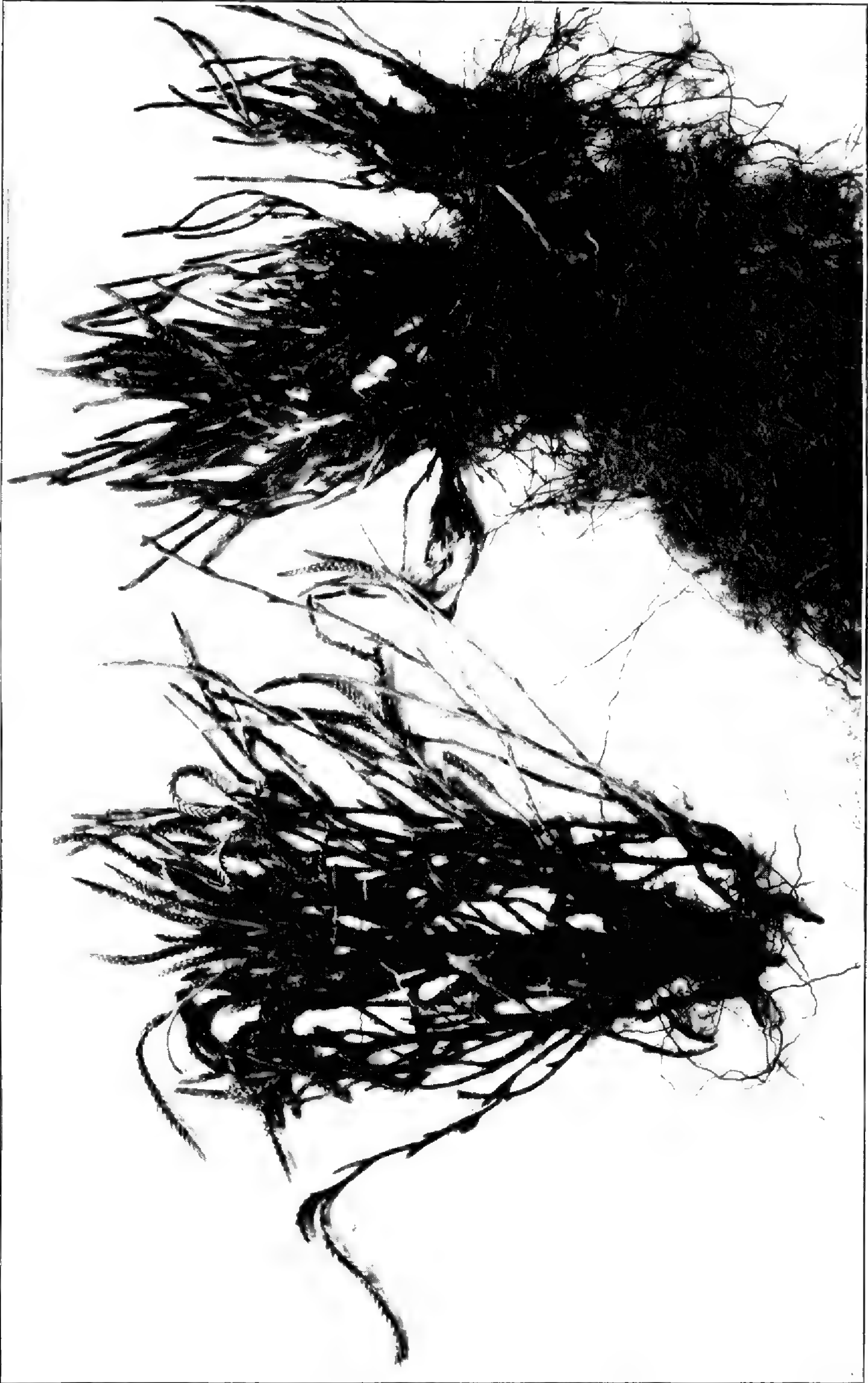


FIG. 70.—Details of *Selaginella rupestris*. a, Dorsal view of leaf; b, ventral view; c, dorsal view of sporophyll; d, ventral view; e, commissural face of megaspore; f, outer face. From specimen collected in Lancaster County, Pennsylvania, *Heller & Halbach* 706; U. S. Nat. Herb., no. 204750. Scale 30.

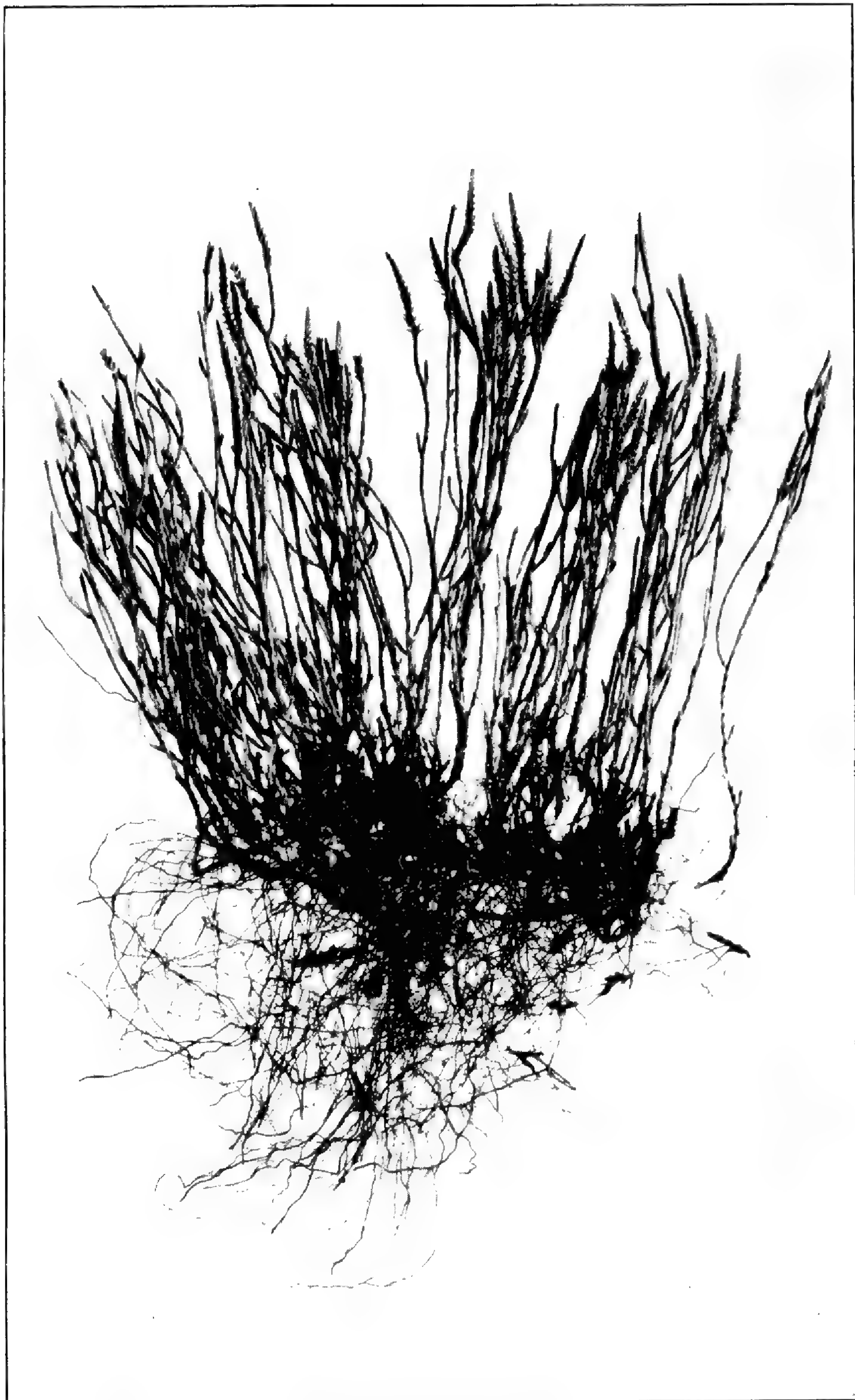
variations in form in the northern and western portions of its range, but the form in the south seems fairly constant. A discussion of this species and its allies in the northern United States will be published in a subsequent paper. The type is from "Virginia."



SELAGINELLA RIDDELLII VAN ESELTINE.



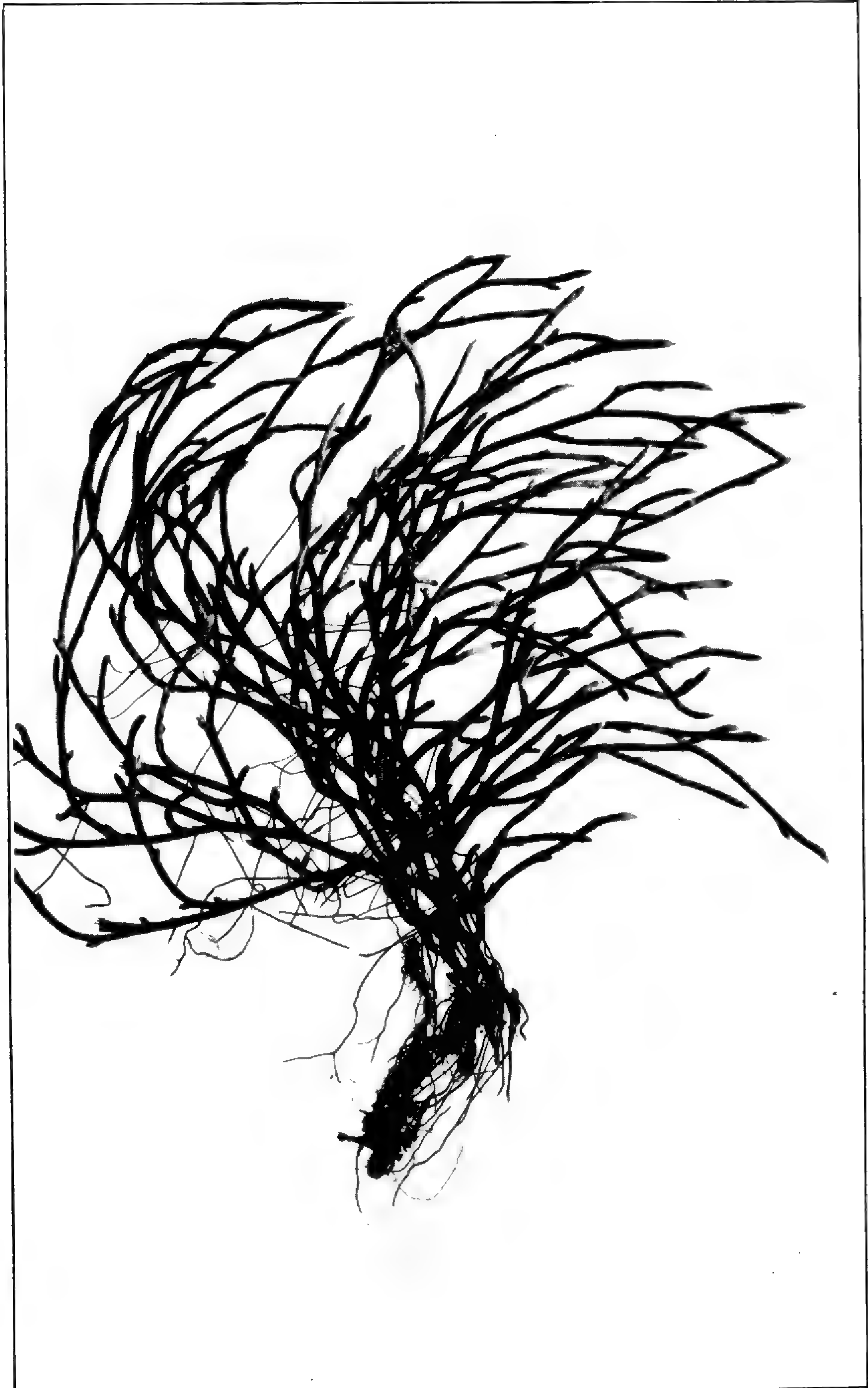
SELAGINELLA ARENICOLA UNDERW.



SELAGINELLA ARENICOLA UNDERW.



SELAGINELLA HUMIFUSA VAN ESELTINE.



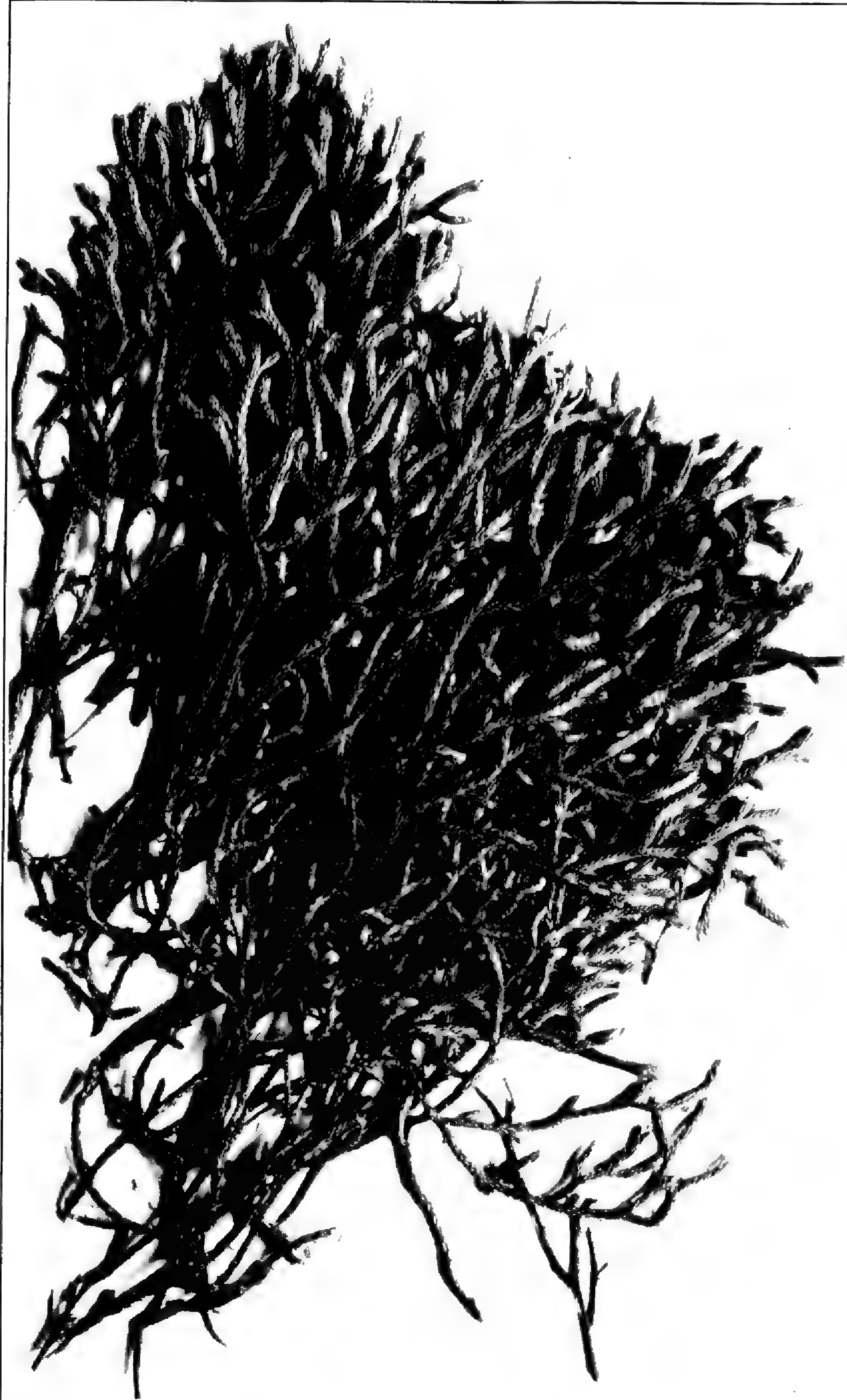
SELAGINELLA FUNIFORMIS VAN ESELTINE.



SELAGINELLA ACANTHONOTA UNDERW.



SELAGINELLA TORTIPILA A. BR.



SELAGINELLA SHERWOODII UNDERW.

STUDIES OF TROPICAL AMERICAN PHANEROGAMS— NO. 3.

BY PAUL C. STANDLEY.

INTRODUCTION.

The third paper of this series¹ is devoted almost wholly to trees and shrubs of tropical and subtropical North America, chiefly those of Mexico. The principal exception is an account of the Panamanian species of *Leiphaimos*, a genus of the Gentianaceae, whose representatives are interesting because of their saprophytic habit and the diverse forms of their flowers.

The writer has been engaged recently upon a proposed systematic account of the woody plants of Mexico, and it is as a result of this work that many of the new species here described are published. Most of the latter belong to the group Leguminosae, although representatives of several other families of Mexican plants are described. There is included, in addition, a brief account of the Mexican and Central American species of *Erythrina*.

In the course of work upon the family Rubiaceae for the North American Flora, numerous plants have been discovered which are not referable to any of the published species. Some of the most interesting of these have been discussed elsewhere,² but others are treated in the present paper. Most of the Rubiaceae described here belong to the genera *Randia* and *Hoffmannia*.

THE MEXICAN SPECIES OF ATELEIA.

Several species of *Ateleia* have been described from South America and the West Indies, but only one, *A. pterocarpa* DC., the generic type, has been reported from Mexico. *Ateleia pterocarpa* was based upon one of Sessé and Mociño's plates, and the writer has been unable to find any published reference to the collection of specimens. There are, however, in the National Herbarium several Mexican col-

¹ See also Contr. U. S. Nat. Herb. 17: 427-458. pls. 24-31. 1914; 18: 87-142. 1916.

² Standley, Paul C., *Blepharidium*, a new genus of Rubiaceae from Guatemala, Journ. Washington Acad. Sci. 8: 58-60. 1918; *Omittemia*, a new genus of Rubiaceae from Mexico, op. cit. 8: 426, 427. 1918.

lections of the genus, at least two of which represent undescribed species.

KEY TO THE SPECIES.

Seeds 12 to 15 mm. long, strongly compressed; leaflets mostly oblong or lance-oblong, 1 to 1.5 cm. wide. Upper suture of the fruit convex—1. *A. arsenii*.

Seeds 5 to 7 mm. long, turgid; leaflets mostly ovate to rounded-oval, usually 2.5 to 5.5 cm. wide.

Upper suture of the fruit straight or concave; seeds about 5 mm. long; leaflets oval or rounded-oval—2. *A. pterocarpa*.

Upper suture of the fruit convex; seeds about 7 mm. long; leaflets mostly oblique-ovate—3. *A. insularis*.

1. *Ateleia arsenii* Standl., sp. nov.

Branchlets copiously tomentose, especially when young, with fulvous hairs; rachis of the leaf 7 to 19 cm. long; leaflets about 15, oblong, lance-oblong, or ovate-oblong, 2.5 to 4.8 cm. long, 1 to 1.5 cm. wide, broadly and obliquely rounded at the base, rounded or very obtuse at the apex, coriaceous, with prominulous, finely reticulate venation, at first short-pilose on the upper surface, but glabrate in age, tomentose beneath when young, the pubescence scant in age; racemes very numerous, 8 to 14 cm. long, loosely many-flowered, the bracts minute, linear-subulate; calyx 4.5 mm. long, turbinate-campanulate, fulvous-tomentulose, very obscurely dentate or entire; blade of the standard petal rounded-oval, 8 to 9 mm. long, 7 to 8 mm. wide, pilose outside, abruptly decurrent to a short slender claw, the margin of the blade irregularly crenulate; stamens only slightly longer than the calyx; fruit about 2.8 cm. long and 1.6 cm. wide, glabrate, prominently reticulate-veined, abruptly decurrent at the base to a stipe 1.5 cm. long, the upper suture convex, sharply carinate but almost exalate; seeds 12 to 15 mm. long, 7.5 to 9 mm. wide, strongly compressed, castaneous.

Type in the U. S. National Herbarium, no. 1000106, collected on Pico de Quinceo, near Morelia, Michoacán, in 1910, by Brother G. Arsène (no. 6655). This specimen consists of fruiting material. Another collection, in flower, was obtained upon the same mountain, at an altitude of 2,800 meters, March 11, 1909, by Brother Arsène (no. 2790).

Readily distinguished from the other Mexican species by the large, flat seeds and small, narrow leaflets. This is the only species of which the writer has seen flowers.

It is a pleasure to be able to name this well-marked species in honor of one of the most assiduous collectors of Mexican plants. During about eight years' residence in Mexico Brother Arsène obtained one of the largest series of the plants of that country ever secured by one collector. This consists of nearly eleven thousand numbers of flowering plants, chiefly from the states of Puebla and Michoacán, besides a large quantity of cryptogams. Through the generosity of Brother Arsène, the most complete series of these collections has now been deposited in the National Herbarium.

2. *Ateleia pterocarpa* DC. Prodr. 2: 419. 1825.

Pterocarpus ateleia Moc. & Sessé; DC. Prodr. 2: 419. 1825, as synonym.

This, the type species of the genus, was based upon one of Sessé and Mocíño's drawings,¹ and De Candolle gives the locality merely as Mexico. In the second edition of their *Flora Mexicana*² Sessé and Mocíño give a long description of

¹ Calq. Dess. Fl. Mex. pl. 288, pl. XXV, A.

² 164. 1894.

the plant under the generic name *Amorpha*, but without a specific designation. In this later work the locality for the plant is given as "In agris Cordovae et in Praedio S. Josephi."

Of the specimens at hand those which agree best with the plate and description were collected at Acaponeta, Tepic, April, 1910, by J. N. Rose, P. G. Russell, and P. C. Standley (no. 14474). The fruit of these specimens agrees almost exactly with that figured. The leaflets, however, are less numerous, broader, and rounded rather than acute at the apex. It is not improbable that the Tepic specimens represent an additional new species, but it is unsafe to describe them as such until some plant agreeing better with the original illustration is collected. The tracings of Sessé and Mocino's plates are so obviously imperfect that no confidence can be placed in the characters they seem to indicate. The writer is unable to determine the location of the localities mentioned by Sessé and Mocino. If the well-known Córdoba in Veracruz is the one referred to, it is probable that the typical plant is still unknown in herbaria.

The specimens obtained by Doctor Rose and the writer were taken from a handsome tree about 6 meters high. The fruit is borne in the greatest profusion. It is about 2 cm. long and 1.3 cm. wide, with the upper suture straight or concave, and bordered by a thin wing about 1 mm. wide.

3. *Ateleia insularis* Standl., sp. nov.

Branchlets strigillose-puberulent, with numerous conspicuous pale lenticels; leaf rachis 15 to 24 cm. long; leaflets about 13, ovate or very obliquely oblong-ovate, 4 to 6.5 cm. long, 2.2 to 3 cm. wide, broadly rounded and very oblique at the base, obtuse at the apex, subcoriaceous, with prominulous, finely reticulate venation, in age nearly glabrous except for a few minute appressed hairs along the veins; racemes 6 to 12 cm. long, rather densely flowered, the flowers short-pedicellate; calyx truncate, strigillose-puberulent, 2.5 mm. long; fruit 2.2 to 3 cm. long, 1.5 to 2 cm. wide, glabrous, the upper suture convex, furnished with a thin wing 2 to 3 mm. wide; seed turgid, about 7 mm. long and 4 mm. wide, dark reddish brown.

Type in the U. S. National Herbarium, no. 345929, collected on María Madre Island, off the Pacific coast of Mexico, May, 1897, by E. W. Nelson (no. 4186). Also obtained at the same locality, May 7, 1897, by F. S. Maltby (no. 73).

Closely related to the Tepic plant discussed above, but sufficiently different in the form of the fruit and leaflets to deserve specific rank. Although only a small amount of Mexican material is available for study, examination of an extensive series of specimens of the Cuban *Ateleia cubensis* Griseb. indicates that the form of the fruit is very constant.

THE MEXICAN AND CENTRAL AMERICAN SPECIES OF ERYTHRINA.

The North American species of *Erythrina* have never been monographed, and no attempt has ever been made to correlate the large number of published names. Many of the species are known only from very imperfect descriptions or from equally unsatisfactory illustrations, and the difficulty of any attempt to formulate a satisfactory account of the genus is increased by the incompleteness of most herbarium specimens. The plants seldom bear flowers and fruit at the same time, and since they often flower when devoid of leaves it is difficult to assemble complete material that is certainly

of the same species. The following account of the continental North American species, though far from satisfactory, will make possible at least an approximate determination of collections.

The plants of this genus are of some economic importance, and there are many references to them in the literature relating to Mexican botany. Unfortunately, their nomenclature is in such confusion that no confidence may be placed in the specific names under which the properties of the plants have been discussed. This, however, is a matter of little importance, since it is probable that most of the species have approximately the same properties. The Mexican plants are generally referred to in literature as *Erythrina corallodendron* or *E. coralloides*. The application of the latter name is uncertain, and *E. corallodendron* probably does not occur in Mexico.

The vernacular names given below under the species have been verified from herbarium specimens. The following names are used in Mexico for the species, probably without discrimination as to specific limits: "Colorín" (Jalisco, Valley of Mexico, Puebla), "zumpantle" (Veracruz, Distrito Federal), "peonía" (Jalisco), "purénchequa" (Michoacán, Tarascan), "pureque" (Michoacán), "tzompantli" (Valley of Mexico), "tzinacanquáhuatl" (Nahuatl), "zompantle" (Valley of Mexico), "chacmol-ché" (Yucatán, Maya), "coralina" (Baja California), "chilacoyote" (seeds, Baja California), "chocolén," "iquimite," "pito" (Veracruz), "patol" (seeds), "pichoco."

The species of *Erythrina* are often planted for hedges, partly because of their usually well-armed branches and partly on account of their showy red flowers. It is stated that the Aztecs used the plants extensively in this way, just as the people of modern Mexico employ them. Branches of the trees or shrubs broken off and placed in the ground root readily. The wood is very soft and light, and is used for the same purposes as cork. The bark furnishes a yellow dye for cloth, etc. The succulent flowers are eaten, either raw or cooked, at Cuernavaca and elsewhere. The handsome seeds have been used by the Mexicans of both pre-Conquest and modern times as articles of ornament.

Various medicinal properties are attributed to the Mexican *Erythrina*s. The roots are said to be sudorific; a decoction of the flowers is sometimes used for chest affections; and the bark is reputed to have purgative and diuretic action. The juice of the stems is reported to have been used as a remedy for scorpion stings. The bark and seeds are said to contain a powerful alkaloid, to which the name erythrine has been given. This alkaloid has a marked effect upon the nervous system, causing paralysis of the motor nerves. If taken internally in sufficient quantities the seeds produce death. They have been used

by the natives of various parts of tropical America as a hypnotic. Because of the characteristic narcotic properties the crushed stems of the plants are sometimes thrown into water to stupefy fish.

KEY TO THE SPECIES.

Standard petal very broad, oval or flabelliform.

Standard long-clawed; leaflets rounded or very obtuse at the apex. Tree, armed with stout spines; corolla orange or salmon-----1. *E. glauca*.

Standard not clawed; leaflets acutish to acuminate at the apex.

Calyx truncate. Tree, armed with small spines-----2. *E. darienensis*.

Calyx bilobate. Shrub, armed with spines; seeds brown, large.

3. *E. breviflora*.

Standard petal narrow, linear to linear-oblong.

Fruit and ovary aculeate. Plants herbaceous.

Calyx dentate-----4. *E. setosa*.

Calyx cleft on one side at the apex, not dentate. Seeds very large, nearly black-----5. *E. leptorhiza*.

Fruit and ovary not aculeate.

Calyx cleft on one side at the apex, or conspicuously bilobate.

Calyx cleft on one side at the apex.

Pods coiled; leaflets ovate or ovate-oblong. Shrub; seeds scarlet.

6. *E. cochleata*.

Pods straight or nearly so; leaflets mostly deltoid. Large or small tree; flowers pink-----7. *E. rubrinervia*.

Calyx bilobate.

Leaflets ovate or lance-ovate; petioles aculeate. Small tree; flowers green and red-----8. *E. lanceolata*.

Leaflets suborbicular or deltoid; petioles usually unarmed.

Venation of the leaflets prominently reticulate; leaflets tomentulose beneath when young; pods only slightly constricted between the seeds-----9. *E. montana*.

Venation of the leaflets not prominently reticulate; leaflets sericeous beneath when young; pods deeply and abruptly constricted between the seeds-----10. *E. costaricensis*.

Calyx truncate.

Standard densely lanate or tomentulose. Shrubs or small trees.

Seeds about 8 mm. long; standard 7 cm. long; pods deeply constricted between the seeds-----11. *E. lanata*.

Seeds about 12 mm. long; standard 5 to 5.5 cm. long; pods shallowly constricted between the seeds-----12. *E. occidentalis*.

Standard glabrous or nearly so.

Leaflets, at least the terminal ones, conspicuously lobate. Shrubs or herbs; seeds scarlet; flowers red-----13. *E. herbacea*.

Leaflets never lobate.

Seeds about 15 mm. long; leaflets usually rounded or very obtuse at the apex-----14. *E. flabelliformis*.

Seeds about 10 mm. long; leaflets usually acute or acuminate at the apex.

Standard 8 cm. long; pods deeply constricted between the seeds; leaflets aculeate beneath-----15. *E. goldmanii*.

Standard 6.5 cm. long or shorter; pods only slightly constricted between the seeds; leaflets not aculeate----16. *E. americana*.

1. *Erythrina glauca* Willd. Ges. Naturf. Freund. Berlin Neue Schrift 3: 428. 1801.

Erythrina patens DC. Prodr. 2: 414. 1825.

Duchassaingia glauca Walp. Ann. Bot. 2: 424. 1851.

TYPE LOCALITY: Caracas, Venezuela.

DISTRIBUTION: Guatemala (*Heyde & Lux* 6329); Nicaragua (*Shannon* 5023, *Baker* 690); Panama (*Pittier* 2571, 6942, 2744; *Fendler* 81; *Maxon* 4790; *Christopherson* 142; *Goldman* 1853). Also in Cuba, Porto Rico, the Lesser Antilles, and Venezuela.

Erythrina patens was based upon one of Sessé and Mociño's plates,¹ which agrees exactly with the present plant. De Candolle gives the habitat as Mexico, but the writer has seen no Mexican specimens. Perhaps the plate was drawn from Guatemalan or Porto Rican specimens.

2. *Erythrina darrienensis* Standl. Contr. U. S. Nat. Herb. 18: 108. 1916.

DISTRIBUTION: Known only from the type locality, near Pauarandó, southern Darién, Panama.

3. *Erythrina breviflora* DC. Prodr. 2: 413. 1825.

Erythrina latiflora Sessé & Moc. Pl. Nov. Hisp. 15. 1887.

Erythrina petraea T. S. Brandeg. Zoe 5: 247. 1908.

TYPE LOCALITY: Ayacapixtla, Mexico.

DISTRIBUTION: Jalisco (*Rose & Painter* 7511); Guanajuato (*Duges* 2); Morelos (*Pringle* 6512); Michoacán (*Pringle* 11964; *Arsène* 2868); Puebla (*Purpus* 5554).

De Candolle's description was based upon one of Sessé and Mociño's plates.² The description by the latter authors is much more ample, and when combined with the illustration leaves no doubt concerning the identity of the species.

Erythrina petraea was based upon Purpus's no. 2680, from Cerro de la Yerba, Puebla. Although the writer has not seen the type, the description applies to the present plant, and other specimens determined by Brandeggee as *E. petraea* evidently belong here. Specimens collected by Purpus in 1908 at the type locality of *E. petraea* are remarkable for their small leaflets.

4. *Erythrina setosa* Mart. & Gal. Bull. Acad. Brux. 10²: 194. 1843.

TYPE LOCALITY: Regla, at 1,800 meters, and the eastern Cordillera of Oaxaca, at 2,100 meters.

DISTRIBUTION: Oaxaca (*Pringle* 4687; *Rose & Hough* 4599; *Conzatti & González* 35; *Conzatti* 1422, 1507).

Probably *Erythrina horrida* DC.³ is the same as *E. setosa*, but the plate of Sessé and Mociño,⁴ upon which De Candolle's description is based, is too poor for certain determination. Perhaps *E. horrida* is, rather, the same as *E. leptorhiza*. De Candolle describes the calyx of the former as 5-dentate, and it is so illustrated, but in view of the fact that the only calyces shown are the old ones investing the stipe of the fruit, it is probable that their delineation is fictitious.

5. *Erythrina leptorhiza* DC. Prodr. 2: 413. 1825.

TYPE LOCALITY: Mexico, the description based on one of Sessé and Mociño's plates.⁵

DISTRIBUTION: State of Mexico (*Rose & Hay* 5410, 5639; *Pringle* 6638, 5743; *Rose & Painter* 7831); Morelos (*Pringle* 6869); Hidalgo (*Pringle* 11965; *Rose & Hay* 5299); Puebla (*Arsène* 10039; *Nicolas* 128); Oaxaca (*Conzatti* 1790); Michoacán (*Arsène* 7220, 6818, 7367).

Known in Michoacán as "patol" and "colorín negro."

Pringle's no. 6638 was distributed as a new species.

¹ Calq. Dess. Fl. Mex. pl. 255. ² Prodr. 2: 413. 1825.

³ Calq. Dess. Fl. Mex.

⁴ Calq. Dess. Fl. Mex. pl. 251. ⁵ Calq. Dess. Fl. Mex. pl. 252.

pl. 250.

6. *Erythrina cochleata* Standl., sp. nov.

Shrub, the branches gray, apparently unarmed; petioles stout, glabrous or nearly so, unarmed; leaflets ovate or ovate-oblong, 10.5 to 15.5 cm. long, 4.5 to 6.5 cm. wide, rounded at the base, narrowed to the acuminate apex, subcoriaceous, concolorous, glabrous at maturity, the venation finely and prominently reticulate; racemes about 6 cm. long, the rachis brown-tomentulose; calyx 2 cm. long, narrow, brown-tomentulose or glabrate, cleft on one side at the top for about 8 mm., the limb acute, with 2 small teeth on each side; standard oblong-linear, 7 cm. long, about 6 mm. wide, glabrous, the keel shorter than the calyx; fruit 2 or 3-seeded, coiled into a complete circle, slightly constricted between the seeds, glabrate, long-stipitate; seeds scarlet, about 9 mm. long.

Type in the U. S. National Herbarium, no. 861527, collected at Hacienda La Colombiana, Costa Rica, by A. Tonduz (no. 223).

The leaflets are similar to those of *E. lanceolata*, a species with a shallowly bilobate calyx. The fruit is quite unlike that of any other species known to the writer.

The vernacular name is given as "poró."

7. *Erythrina rubrinervia* H. B. K. Nov. Gen. & Sp. 6: 434. 1823.

TYPE LOCALITY: Near Fusagasuga, Colombia.

DISTRIBUTION: Oaxaca (*Nelson* 1966); Veracruz (*Nelson* 435, 79); Chiapas (*Nelson* 3842); Guatemala (*Goll* 246; *Heyde & Lux* 3293); El Salvador (*Pittier* 1930); Nicaragua (*Baker* 631); Panama (*Pittier* 2541, 6939, 4731). Also in Colombia.

Known in Guatemala as "pito."

Erythrina berteriana Urban,¹ described from Cuba and Colombia, seems to be this species. The Veracruz specimens have a slightly shorter standard than the more southern ones, but do not differ otherwise.

8. *Erythrina lanceolata* Standl. Contr. U. S. Nat. Herb. 17: 432. 1914.

DISTRIBUTION: Known only from the type locality, San Cristóbal de Candelaria, Costa Rica.

9. *Erythrina montana* Rose & Standl., sp. nov.

Stems herbaceous, from a stout elongate root, tomentulose when young but soon glabrate; leaflets suborbicular, deltoid-orbicular, or ovate-deltoid, 4 to 13 cm. long, 3 to 9 cm. wide, truncate or broadly rounded at the base, rounded to very acute at the apex, thick, bright green, concolorous, tomentulose along the veins when young, usually minutely aculeolate beneath along the veins, the venation very prominently reticulate on both surfaces; calyx 1.2 to 2.7 cm. long, thin, sparsely tomentulose or glabrate, shallowly bilobate; corolla apparently purplish green, the standard 5 to 7 cm. long, 0.8 to 1.2 cm. wide, slightly curved, glabrous; fruit 1 to 4-seeded, slightly constricted between the seeds, nearly glabrous.

Type in the U. S. National Herbarium, no. 301042, collected in the Sierra Madre, near Santa Teresa, Tepic, Mexico, August 9, 1897, by J. N. Rose (no. 2137).

ADDITIONAL SPECIMENS EXAMINED:

DURANGO: Otinapa, 1906, *Palmer* 450. Durango, 1896, *Palmer* 362. Near El Salto, July, 1898, *Nelson* 4546.

JALISCO: Chiquilistlán, May, 1892, *Jones* 180.

ZACATECAS: Near Plateado, September, 1897, *Rose* 3634. Near Monte Escobedo, August, 1897, *Rose* 3597.

¹ Symb. Antill. 5: 370. 1908.

Because of the herbaceous habit, the prominently veined leaflets, and the form of the calyx, the proposed species is evidently related to the more southern *E. leptorhiza*. The absence of spines on the fruit is sufficient to distinguish the present plant specifically.

10. *Erythrina costaricensis* Micheli, Bull. Herb. Boiss. 2: 445. pl. 12. 1894.

TYPE LOCALITY: River banks near Boruca, Costa Rica.

DISTRIBUTION: Costa Rica (*Cook & Doyle* 284; *Tonduz* 12805, 13926, 10050); Panama (*Pittier* 2287, 2656; *Goldman* 1854; *Maxon* 4808; *Williams* 782).

The Costa Rican vernacular names are given as "elekeme," "coralillo," and "poro."

11. *Erythrina lanata* Rose, U. S. Dept. Agr. N. Amer. Fauna 14: 81. fig. 1. 1899.

TYPE LOCALITY: Acapulco, Guerrero.

DISTRIBUTION: Guerrero (*Palmer* 129, type); Oaxaca (*Nelson* 2699).

12. *Erythrina occidentalis* Standl., sp. nov.

Shrub or small tree, the branches gray, tomentulose when young, armed with numerous short stout spines, or sometimes perhaps unarmed; petioles slender, unarmed or bearing 1 or 2 short curved spines; leaflets broadly deltoid or rhombic, 5 to 17 cm. long, 4 to 12.5 cm. wide, usually truncate at the base, rarely broadly cuneate, very acute to acutish at the apex, thin, bright green above, usually somewhat paler beneath, tomentulose when young but soon glabrate; racemes dense, elongate; calyx 8 to 10 mm. long, closely white-tomentulose, obliquely truncate, the limb obscurely denticulate; standard oblong-linear, 5 to 5.5 cm. long, 7 to 8 mm. wide, thinly white-tomentulose; fruit 18 to 28 cm. long, 5 to 10-seeded, slightly constricted between the seeds, at first densely white-tomentulose but later glabrate; seeds scarlet, about 12 mm. long.

Type in the U. S. National Herbarium, no. 636555, collected along the beach at Mazatlán, Sinaloa, Mexico, March 30, 1910, by J. N. Rose, P. C. Standley, and P. G. Russell (no. 13725).

ADDITIONAL SPECIMENS EXAMINED:

SINALOA: Rosario, July, 1897, *Rose* 1822, 1592. Near Colomas, July, 1897, *Rose* 1796. Guadalupe, April, 1910, *Rose, Standley & Russell* 14732. Culiacán, October 30, 1904, *Brandege*. La Rastra, March, 1899, *Goldman* 365.

TEPIC: María Madre Island, May, 1897, *Maltby* 127, *Nelson* 4303.

The plant is leafless at time of flowering, and none of the specimens cited show both flowers and leaves. Probably, however, all are referred here correctly, though some were referred by Rose to *E. lanata* at the time of publication of that species. The present plant is most closely related to *E. lanata*, but differs in its smaller standard, this with a much less dense indument, its larger seeds, and its less constricted pod.

13. *Erythrina herbacea* L. Sp. Pl. 706. 1753.

TYPE LOCALITY: Carolina.

DISTRIBUTION: Tamaulipas (*Palmer* 130, 328, 119, 544; *Pringle* 7687); San Luis Potosí (*Palmer* 219; *Pringle* 5123; *Rose & Hough* 4869). Also northward and eastward along the Gulf and Atlantic coasts to North Carolina.

So far as the writer knows, *E. herbacea* has not been reported previously from Mexico. All the Mexican specimens appear to have been taken from shrubs, although in many parts of its range the species is truly herbaceous, the stems dying to the ground each year. The shrubby Florida form has been

recognized as a distinct species, *E. arborea* Small,¹ but it seems to differ from typical *E. herbacea* only in habit.

14. *Erythrina flabelliformis* Kearney, Trans. N. Y. Acad. 14: 32. 1894.

Erythrina purpusi T. S. Brandeg. Zoe 5: 158. 1903.

TYPE LOCALITY: Near Fort Huachuca, Arizona.

DISTRIBUTION: Sonora (*Rose, Standley & Russell* 12707, 12943; *Mearns* 335, 376; *Hartman* 41); Baja California (*Nelson & Goldman* 7241, 7353); Sinaloa (*Palmer* 771); Durango (*Palmer* 179); Jalisco (*Rose & Hough* 4774, 4811; *Rose* 2887; *Pringle* 7626, 8658); Zacatecas (*Rose* 3554, 3612); Guanajuato (*Rose & Hough* 4835); San Luis Potosí (*Palmer* 686); Hidalgo (*Nelson* 3880; *Pringle* 6839; *Rose & Hay* 5301); Morelos (*Rose & Hough* 4346a). Also in southeastern Arizona and southwestern New Mexico.

15. *Erythrina goldmanii* Standl., sp. nov.

Branches fruticose, gray, sparsely pilose when young, armed with numerous very stout, short spines; petioles stout, bearing few stout recurved spines; leaflets rounded-ovate or suborbicular, 3.5 to 9 cm. long, 3 to 6.5 cm. wide, rounded at the base, abruptly acuminate at the apex, thick, concolorous, pilose when young but soon glabrate, the venation rather prominently reticulate, the veins armed beneath with few stout recurved spines; calyx about 1 cm. long and broad, glabrous or nearly so, somewhat obliquely truncate; standard oblong-linear, about 8 cm. long and 1 cm. wide, the wings only slightly exceeding the calyx; fruit several-seeded, 12 to 16 cm. long, deeply constricted between the seeds; seeds 9 to 10 mm. long, scarlet.

Type in the U. S. National Herbarium, no. 470671, collected at San Vicente, Chiapas, Mexico, April 20, 1904, by E. A. Goldman (no. 870).

A fruiting specimen, collected at La Razón, Chiapas, by Goldman (no. 1039), also belongs here.

Erythrina goldmanii is closely related to *E. americana*, but seems distinct in its larger flowers, deeply constricted pods, and aculeolate leaflets.

16. *Erythrina americana* Mill. Gard. Dict. ed. 8. *Erythrina* no. 5. 1768.

Erythrina carnea Alt. Hort. Kew. 3: 8. 1789.

TYPE LOCALITY: Veracruz.

DISTRIBUTION: Oaxaca (*Pringle* 6271; *Rose & Hough* 4627; *Conzatti* 1676); Morelos (*Rose & Hough* 4346; *Rose & Hay* 5351); Distrito Federal (*Pringle* 6838); Veracruz (*Nelson* 79); Yucatán (*Millspaugh* 306; *Schott* 831); Chiapas (*Goldman* 834); Puebla (*Arsène* 2372).

A fruiting specimen from San Luis Potosí (*Nelson* 4386) may belong here, but it has very large, thin, subattenuate leaflets; the form of the calyx is not determinable. A flowering specimen from Veracruz (*Orcutt* 3398) probably should be referred to *E. americana*, although the flowers are smaller than is usual in the species.

Erythrina coralloides DC.,² based upon Sessé and Mocino's plate³ of a Mexican plant, is probably a synonym. The illustration, however, is so imperfect that it is impossible to be certain that it does not represent *E. flabelliformis*.

Specimens of *E. americana* have been determined as *E. corallodendron* L. That is a West Indian species, distinguished by a broad standard and red and black seeds.

The vernacular name in Puebla is "colorín."

¹ Fl. Southeast. U. S. 647. 1903.

² Prodr. 2: 413. 1825.

³ Calq. Dess. Fl. Mex. pl. 253.

DOUBTFUL SPECIES.

ERYTHRINA DIVARICATA DC. Prodr. 2: 414. 1825.

Based upon one of Sessé and Mocino's plates,¹ and said to be a Mexican plant. The standard, as illustrated, is very broad, and the plate does not agree with any material seen by the writer.

ERYTHRINA LONGIPES DC. Prodr. 2: 413. 1825.

This, too, was based upon one of Sessé and Mocino's plates.² The copy of the plate seen by the writer is poorly drawn, and it is impossible to place the plant with certainty.

ERYTHRINA PRINCEPS Dietr. In Otto & Dietr. Allg. Gartenz. 2: 305. 1834.

Described from Mexico. Not identifiable from the description.

ERYTHRINA ROSEA Dietr. In Otto & Dietr. Allg. Gartenz. 2: 253. 1834.

Described from Mexico. Identity doubtful.

FOUR NEW SPECIES OF CAPPARIDACEAE FROM MEXICO AND CENTRAL AMERICA.

The family Capparidaceae is extensively represented in Mexico by both herbaceous and arborescent species. One of the most interesting of these is a new genus described a few years ago by Brandegee³ under the name *Setchellanthus*. The most noteworthy of those here described are the two species of *Forchammeria*, a very abnormal genus, concerning whose systematic position there has been great difference of opinion. *Forchammeria* is confined to Mexico, and only three older species are known.

Capparis discolor Standl., sp. nov.

Tree, 8 to 10 meters high, glabrous throughout, the branchlets slender, blackish brown; petioles slender, 2 to 7.3 cm. long; leaf blades elliptic-oblong, 10.5 to 15 cm. long, 3 to 6 cm. wide, narrowed to the obtuse base, acutely acuminate at the apex, broadest at the middle, bright green above, sublustrous, the venation prominent, closely reticulate, pale and brownish beneath, the costa and lateral nerves salient; flowers few, white, in a terminal raceme, the pedicels 3.5 to 4.3 cm. long; calyx lobes deltoid, subacute, 2 mm. long, reflexed in anthesis; petals elliptic-oblong, 12 to 15 mm. long, obtuse; stamens numerous (about 40), the filaments 3 to 4.5 cm. long, tortuous or spirally coiled, glabrous, the anthers about 2 mm. long; ovary ellipsoid, the stipe about as long as the filaments.

Type in the U. S. National Herbarium, no. 385447, collected on the banks of the Río Petatlán, Guerrero, Mexico, altitude 450 meters, November 24, 1898, by E. Langlassé (no. 558).

A species of the section *Capparidastrum*. It differs from the previously described Mexican and Central American species of that group in the very long petioles, those of the other species being only 1 cm. long or often much shorter. *C. macrophylla* H. B. K., of Colombia, also has long petioles, but the leaf blades are much larger and proportionally broader.

¹ Calq. Dess. Fl. Mex. pl. 256.

² Calq. Dess. Fl. Mex. pl. 254.

³ Univ. Calif. Publ. Bot. 3: 378. 1909.

The collector states that the native name is "naranjillo," and that the flowers have the odor of orange blossoms.

***Forchammeria macrocarpa* Standl., sp. nov.**

Branchlets yellowish, angulate, glabrous; petioles stout, 5 to 7 mm. long, minutely pilose or glabrate; leaf blades linear, 9 to 17.5 cm. long, 5 to 7 mm. wide, gradually attenuate to the base, rarely rounded, gradually narrowed to the acute or acutish apex, coriaceous, pale green, minutely hirtellous on the upper surface or glabrate, sulcate along the costa, densely short-pilose beneath, the costa prominent, the venation closely reticulate and prominent on both surfaces but more prominent beneath, the margin revolute; pistillate racemes few-flowered, glabrous, the pedicels in fruit stout, 10 to 15 mm. long; fruit ellipsoid-globose, about 1.8 cm. long, 1.2 to 1.5 cm. in diameter, glabrous.

Type in the U. S. National Herbarium, no. 841145, collected in the vicinity of San Luis Tultitlanapa, Puebla, Mexico, in 1908, by C. A. Purpus (no. 3417).

The only other species of *Forchammeria* with linear leaves is *F. watsoni* Rose, which ranges from Sinaloa to Baja California. In that the leaf blades are almost invariably emarginate at the base, less densely pubescent, and shorter, the fruiting pedicels are scarcely half as long, and the fruit is much smaller.

***Forchammeria lanceolata* Standl., sp. nov.**

Shrub or small tree, 3 to 4.5 meters high, glabrous throughout, the branchlets slender, grayish, with numerous prominent pale lenticels; leaves simple, the petioles 4 to 6 mm. long, the blades mostly lanceolate but varying to ovate or lance-elliptic, 6 to 8.2 cm. long, 1.7 to 3.2 cm. wide, unequal at the obtuse base, acute or acuminate at the apex, coriaceous, pale green, lustrous, the costa salient beneath, the venation prominulous and closely reticulate on both surfaces; flowers axillary, solitary, fasciculate, or in very short few-flowered racemes, the pedicels stout, 6 to 8 mm. long; fruit broadly oval, 12 to 13 mm. long, 8 to 9 mm. in diameter.

Type in the Gray Herbarium, collected somewhere in Mexico, in 1891, by C. G. Pringle (no. 3728).

Readily distinguished from the other species by the form of the inflorescence and the shape of the leaves.

***Steriphoma macrantha* Standl., sp. nov.**

Branchlets stout, densely ferruginous-pubescent with stellate hairs; petioles slender, 4 to 10.5 cm. long, finely stellate-pubescent; leaf blades elliptic or elliptic-ovate, 14.5 to 27 cm. long, 5 to 10 cm. wide, acute or acutish at the base, narrowed to the acuminate or long-acuminate apex, membranaceous, green above, glabrous, slightly paler beneath, very sparsely and minutely stellate-pubescent or glabrate; racemes about 15 cm. long, densely many-flowered, the bractlets linear-subulate, caducous; pedicels 3 to 4 cm. long; calyx about 2 cm. long, densely orange-pubescent with close stellate hairs, the lobes acute; petals 2 to 2.5 cm. long, narrowly oblanceolate, acute or acutish; filaments 7 to 8 cm. long; carpophore about 11 cm. long, glabrate; young fruit densely stellate-puberulent.

Type in the U. S. National Herbarium, no. 716626, collected in forests around Pinogana, southern Darién, Panama, April, 1914, by H. Pittler (no. 6561).

The flowers and leaves are nearly twice as large as in the other species of the genus.

***Crataeva palmeri* Rose, Contr. U. S. Nat. Herb. 1: 301. 1895.**

This species is distinguished from all others of the genus by the copious pubescence. The type was collected at Armeria, Colima, but the species has

a rather wide range, as shown by the following specimens in the National Herbarium.

SINALOA: Guadalupe, 1910, *Rose, Standley & Russell* 14676. Culiacán, 1910, *Rose, Standley & Russell* 14846. San Blas, 1910, *Rose, Standley & Russell* 13210. Fuerte, 1910, *Rose, Standley & Russell* 13482.

DURANGO: Without locality, August 15, 1897, *Rose*.

JALISCO: Between Bolaños and Guadalajara, September 19, 1897, *Rose*.

GUERRERO: Paso de las Vacas, 1903, *Nelson* 6973.

COLIMA: Colima, 1897, *Palmer* 117.

NEW MIMOSACEAE FROM MEXICO.

Few, if any, families of plants are represented in Mexico by a larger number of woody species than the Mimosaceae. Their study is made difficult by the fact that there are no monographic accounts available except those published by Bentham many years ago. Although Bentham's work is almost unrivaled in accuracy and lucidity, recent botanical explorations in Mexico have shown that his monographs are now too incomplete to be generally useful. There is a recent account of the genus *Mimosa*, by Robinson,¹ but there is no adequate literature covering the other groups. Eight new species of *Acacia*, one of *Calliandra*, two of *Leucaena*, and four of *Pithecollobium* are described below.

Acacia polypodioides Standl., sp. nov.

Stems slender, brown or purplish, copiously hirsute with slender stiff hairs, also puberulent and furnished with numerous minute sessile glands, unarmed; petioles 1.5 to 2.5 cm. long, hirsute and puberulent, eglandular, the pinnae 4 to 7 pairs, 2.5 to 6 cm. long; leaflets 12 to 25 pairs, oblong, 2.5 to 6 mm. long, 1 to 2.5 mm. wide, divaricate or ascending, obliquely truncate at the base, obtuse or rounded at the apex, chartaceous, dark green above, sublustrous, densely puberulent, paler beneath, densely puberulent with curved hairs or glabrate, the costa prominent beneath, the lateral nerves also usually prominent, the margin revolute or subrevolute; flowers capitate, pedicellate, the heads axillary or short-racemose, the peduncles 1 to 1.5 cm. long, hirsute or puberulent, bracteate above the middle; calyx 0.8 mm. long, broadly campanulate, obscurely lobate, minutely pilose or puberulent; corolla 3 times as long as the calyx or longer, the lobes oblong, acute, strigose; stamens long-exserted; fruit long-stipitate, flat, 3.5 to 5.5 cm. long, 7 to 10 mm. wide, acute or abruptly short-decurrent at the base, rounded at the apex and rostrate, densely puberulent, the valves very thin.

Type in the U. S. National Herbarium, no. 470796, collected at Chiapa, Chiapas, Mexico, May 18, 1904, by E. A. Goldman (no. 1001).

The following additional collections belong here:

OAXACA: Vicinity of San Juan Guichicovi, alt. 135 to 450 meters, *Nelson* 2726. Las Pilas (Cerro Espino), alt. 400 meters, *Reko* 3612, 3755.

NICARAGUA: Granada, *Baker* 2325.

Acacia polypodioides is a member of Bentham's series *Filicinae*, and is related to *A. filicioides* (Cav.) Trel., *A. angustissima* (Mill.) Kuntze, and allied species. It is distinguished by the pubescent corolla and the peculiar

¹ Proc. Amer. Acad. 33: 305-331. 1898.

pubescence of the leaflets. The most striking character, however, which gives it an appearance decidedly different from the related species, is found in the more or less revolute margins of the leaflets. The pinnae closely resemble the fronds of certain species of *Polypodium*, hence the specific name.

***Acacia leucothrix* Standl., sp. nov.**

Unarmed shrub, the branches stout, subtortuous, grayish, densely white-hirsute; stipules 2 to 3 mm. long, linear, persistent; petioles 3 to 7 mm. long, hirsute, eglandular, the pinnae 3 or 4 pairs, 1 to 1.5 cm. long, the rachis densely hirsute; leaflets 9 to 14 pairs, oblong or linear-oblong, 2 to 4 mm. long, 1 mm. wide or narrower, obliquely rounded at the base, rounded at the apex, chartaceous, glabrous, green above, slightly paler beneath, the costa and lateral nerves prominulous beneath, the margin plane; flowers glabrous, capitate, pedicellate, the heads axillary, solitary, the peduncles 8 to 13 mm. long, hirsute, bracteate near the apex; calyx 0.8 mm. long, broadly campanulate, obscurely lobate; corolla 3 times as long as the calyx, the lobes oblong, acute; stamens very numerous, long-exserted; fruit short-stipitate, flat, 3.5 to 5 cm. long, 6 to 7 mm. wide, attenuate to the base, rounded to acute at the apex and rostrate, glabrous, the valves very thin, prominently reticulate-veined; seeds suborbicular, subcompressed, 3 mm. long, olivaceous or grayish.

Type in the U. S. National Herbarium, no. 471006, collected at San Dieguito, San Luis Potosí, Mexico, June, 1904, by Edward Palmer (no. 143). Also collected in lowland meadows near Tampico, Tamaulipas, September 3, 1902, by C. G. Pringle (no. 9717).

Closely allied to the plant referred by Small and others to *Acacia cuspidata* Schlecht., but strikingly different in pubescence.

***Acacia laevis* Standl., sp. nov.**

Stems slender, terete, purplish brown, glabrous, unarmed; stipules 4 to 5 mm. long, linear, hirsute-ciliate; petioles 4 to 6 cm. long, without glands; pinnae 8 to 11 pairs, the leaflets about 30 pairs, oval or oblong-oval, 3 to 5.5 mm. long, 1.5 to 2.8 mm. wide, obliquely semicordate at the base, rounded or very obtuse at the apex, subcoriaceous, glabrous, green above, the venation mostly plane, paler beneath, the venation prominent and laxly reticulate, the margin plane, appressed-ciliolate; flowers capitate, pedicellate, the heads partly axillary and partly in a long naked raceme, the peduncles 2 to 2.5 cm. long, fasciculate, glabrous, the bracts small, linear; flowers glabrous, the calyx about 1 mm. long, campanulate, truncate, the corolla 3 mm. long; stamens very numerous, long-exserted; fruit (immature) about 5.5 cm. long and 8 mm. wide, long-stipitate, attenuate to the base, rounded and rostrate at the apex, glabrous, glaucescent, the valves very thin.

Type in the U. S. National Herbarium, no. 296758, collected near Guadalajara, Jalisco, Mexico, July 21, 1902, by C. G. Pringle (no. 11354).

Closely related to *A. tequilana* S. Wats., and perhaps only a form of that species. In *A. tequilana*, however, the pinnae are only 3 to 5 pairs, and the leaflets several times as large and much broader in outline.

***Acacia penicillata* Standl., sp. nov.**

Stems slender, terete, purplish and glaucescent, glabrous, unarmed; stipules linear, about 4 mm. long; petioles 4.5 to 9 cm. long, glabrous, eglandular, the pinnae 3 to 5 pairs; leaflets 15 to 30 pairs, oblong-oval, 6 to 14 mm. long, 3.5 to 8 mm. wide, obliquely semicordate at the base, broadly rounded at the apex, chartaceous, glabrous, dark green or at first glaucescent above, paler beneath, the venation prominulous-reticulate, the margin plane, appressed-ciliolate; flowers capitate, pedicellate, the heads arranged in a long raceme, the peduncles

fasciculate, 2.5 to 4 cm. long, glabrous, the bracts ovate-oblong, 4 to 5 mm. long; flowers glabrous, the calyx campanulate, shallowly lobate, glaucescent, the corolla 3.5 to 4 mm. long, the lobes ovate, obtuse; stamens very numerous, long-exserted; fruit long-stipitate, 6.5 to 8.5 cm. long, 0.9 to 1.3 cm. wide, straight, flat, acute or attenuate at the base, rounded and rostrate at the apex, glabrous, glaucescent, the valves thin, reticulate-veined; seeds brown-olivaceous, 5 mm. long, 4 mm. wide, compressed, smooth.

Type in the U. S. National Herbarium, no. 371953, collected on Cerro de San Felipe, Oaxaca, Mexico, altitude 2,000 meters, August 29, 1897, by C. Conzatti and V. González (no. 564).

The description of the fruit is based upon a specimen collected somewhere in Jalisco, in 1897, by J. N. Rose (no. 3008a). It is possible that this collection is not conspecific with the type.

Acacia penicillata, like *A. laevis*, described above, is closely related to *A. tequilana*, and perhaps only an extreme variant of it. The leaflets are so much smaller and narrower in the present plant, however, that it seems probable that it is specifically different.

***Acacia conzattii* Standl., sp. nov.**

Branches slender, dark gray or brownish, with many small pale lenticels, hirtellous when young, armed with numerous pairs of stipular spines, these stout, straight, 0.8 to 3.3 cm. long, connate at the base; petioles slender, 1.5 to 2.5 cm. long, sparsely and minutely hirtellous or glabrate, with an excavate gland near the base; pinnae one pair, the leaflets 2 pairs (the lower leaflets alternate), oblong, oblong-obovate, or ovate, the terminal ones asymmetric, obtuse or rounded at the unequal base, rounded to acute at the apex, mucronulate, chartaceous, bright green, with prominent or prominulous venation, minutely pilose beneath along the costa but elsewhere glabrous; flowers spicate, sessile, the spikes dense, 2 to 5 cm. long, the peduncle very short, pilose, subtended at the base by a tubular-campanulate involucrel; bractlets filiform-spatulate, minutely pilose; calyx half as long as the corolla, puberulent on the upper part; stamens numerous, long-exserted.

Type in the U. S. National Herbarium, no. 572217, collected at Estación Almoloyas, Oaxaca, Mexico, altitude 700 meters, March, 1907, by C. Conzatti (no. 1756).

Related to *Acacia pringlei* Rose, a species distinguished from the present plant by its short spines and large, proportionally broader leaflets.

***Acacia sororia* Standl., sp. nov.**

Branches stout, terete, dark gray or blackish, with few scattered stout spines 2 mm. long, the young branches densely cinereo-puberulent; petioles stout, 6 to 15 mm. long, with a large excavate gland at the apex; rachis of the leaves densely pilose with minute whitish hairs, the pinnae 2 or 3 pairs; leaflets 1 or 2 pairs, sessile, obliquely oval, suborbicular, or flabellate-orbicular, 0.9 to 2.5 cm. long, 0.7 to 2 cm. wide, rounded and very unequal at the base, broadly rounded at the apex, thick-coriaceous, densely cinereo-puberulent, palmately nerved, the venation prominent, especially beneath; flowers spicate, sessile, the spikes 1.3 to 2 cm. long, the peduncles solitary, 1.5 to 2.5 cm. long, densely and minutely pilose; calyx densely and minutely pilose; fruit stipitate, 4.5 to 8 cm. long, 1.5 to 2.5 cm. wide, straight or slightly curved, densely cinereo-puberulent, the stipe stout, 5 to 10 mm. long, the valves thick and hard, abruptly decurrent into the stipe, rounded and rostrate at the apex, usually slightly constricted between the seeds, the edges thickened; seeds 3 or 4, ovate-orbicular, strongly compressed, about 13 mm. long and 11 mm. wide, dark castaneous.

Type in the U. S. National Herbarium, no. 453250, collected near Higuierillas, Querétaro, Mexico, August 23, 1905, by J. N. Rose, J. H. Painter, and J. S. Rose (no. 9761). Also collected at the same place, on the same date, by F. Altamirano (no. 1668).

The only closely related Mexican acacia is *A. reniformis* Benth., described from the same general region, a species not represented in the National Herbarium. It is possible that *A. sororia* is only a form of *A. reniformis*, but Bentham's excellent description and illustration indicate several important differences. *A. reniformis* is described as "undique glaberrima"; the flowers are pedicellate and glabrous; and the pinnae are only one or two pairs, each with a single pair of leaflets. The stipules, too, are large and reniform and persistent, while in the specimens of *A. sororia*, although some of the leaves are immature, the stipules have all fallen.

***Acacia rosei* Standl., sp. nov.**

Branchlets brown, glabrous or sparsely puberulent, unarmed; petioles 2 to 4 cm. long, without a large gland but with numerous minute ones, these scarcely elevated; rachis of the leaf (when present) 1.5 to 2.5 cm. long, the pinnae 1 or 2 pairs, the leaflets 2 or 3 pairs, oval, oval-elliptic, or ovate-oval, the terminal ones slightly asymmetric, 2.5 to 5 cm. long, 1.4 to 2.5 cm. wide, rounded at the base, obtuse or rounded at the apex, chartaceous, with prominent or prominulous venation, green above, pale beneath, with a few short scattered hairs along the veins, elsewhere glabrous, the margin plane or sub-revolute, ciliolate; flowers white, pedicellate, capitate, the heads few, paniculate, the penduncles shorter than the heads, puberulent; calyx puberulent; corolla glabrous, 3 times as long as the calyx; stamens very numerous; fruit slender-stipitate, straight, the valves very thin, 3 to 4.5 cm. long, 0.9 to 1.4 cm. wide, acute at the base, rounded and rostrate at the apex, brown, prominently reticulate-veined; seeds olivaceous, 3.5 to 4 mm. long, very slightly compressed.

Type in the U. S. National Herbarium, no. 636502, collected on Observatory Hill, Mazatlán, Sinaloa, Mexico, March 30, 1910, by J. N. Rose, P. C. Standley, and P. G. Russell (no. 13673).

Because of the pedicellate flowers and the absence of petiolar glands it is evident that this plant belongs to the series *Filicinae* of Bentham, but it is not closely related to any of the described species of that group. It somewhat resembles *A. crinita* T. S. Brandeg., a species of the same region, notable for its hispid stems.

***Acacia vernicosa* Standl., sp. nov.**

Shrub, 1 to 2 meters high, viscid throughout with minute glands, these not at all elevated, the branches reddish brown, glabrous or nearly so, armed with numerous stipular spines, these stout, gray or white, 0.5 to 1.6 cm. long; petioles 3 to 7 mm. long, usually with a minute gland at the apex, the pinnae 1 or 2 (very rarely 3) pairs; leaflets 7 to 9 pairs, oval or oval-oblong, 1.2 to 3 mm. long, 0.5 to 1.2 mm. wide, rounded at each end, very thick, extremely viscid, glabrous, plane, the venation obscure; inflorescence capitate, dense, the peduncles axillary, 1 to 2 cm. long, usually glabrous, the small involucre borne at or above the middle; flowers glabrous, yellow; fruit 4 to 7 cm. long, 2.5 to 4 mm. wide, dehiscent, the valves thin, convex, brown, lustrous, more or less constricted between the seeds; seeds oblong, 4 to 6 mm. long, gray, spotted with black.

Type in the U. S. National Herbarium, no. 573848, collected in the vicinity of Santa Rosalia, Chihuahua, Mexico, altitude about 1,200 meters, June, 1908, by Edward Palmer (no. 385).

The following additional specimens are in the National Herbarium:

TEXAS: El Paso, *Jones* 4218, *Stearns* 77; in 1881, *Vasey*. Del Rio, June 13, 1891, *Dewey*. Kent, *Tracy & Earle* 411. Mouth of Pecos River, *Bailey* 269. Boquillas, *Bailey* 356.

NEW MEXICO: Tortugas Mountain, *Standley* 6446. Mesa west of Organ Mountains, *Wooton* 129; June 13, 1906, *Standley*; August 19, 1906, *Wooton & Standley*. La Luz Canyon, August 27, 1901, *Wooton*. Lake Valley, 1914, *Mrs. Ida M. Beals*. North of Emory Peak, *Mearns* 305. Without locality, *Vasey* 130. Big Hatchet Mountains, *Goldman* 1342. Eddy, *Bailey* 142.

ARIZONA: Near Fort Huachuca, *Wilcox* 415, 181. Huachuca Plains, *Lemon* 156. San Bernardino Ranch, *Mearns* 711.

CHIHUAHUA: Near Chihuahua, *Pakner* 116; *Rose & Hough* 4216; *Pringle* 370. Sabina, *Rose & Hay* 5264. Between Casas Grandes and Sabinal, *Nelson* 6370.

ZACATECAS: Cañitas, *Rose & Hay* 5266.

QUERÉTARO: Near Higuierillas, *Rose, Painter & Rose* 9762. Between Vizarrón and Higuierillas, *Altamirano* 1696.

Part of the material distributed as *Wright* 1050 and *Mexican Boundary Survey* 327 also belongs to this species.

The material here segregated as *Acacia vernicosa* has always been referred to *A. constricta* Benth. The two species are closely related and do not have separate ranges, but at the same time they seem to be clearly distinct. In *A. constricta* the pinnae are 4 to 9 pairs, the leaves are usually pubescent, and the leaflets are almost twice as large and very slightly or not at all viscid. Bentham evidently had both plants before him when the description of *A. constricta* was written, for he states¹ that the leaves of the sterile branches are more luxuriant, puberulent, with 4 to 6 pairs of pinnae, while those of the flowering branches are glabrous, with usually 2 pairs of pinnae. The writer is unable to find any indication that the difference in number of pinnae may be explained in this way. All the numerous specimens examined are clearly of one form or the other, and the two species are found associated on only one sheet, consisting of specimens collected by Wright (no. 1050). In this case, and in view of the method by which Wright's collections were distributed, it seems not improbable that the two plants came from widely separated localities.

Because of the fact that Bentham's description was based upon material of both species, there is naturally some question as to which should be taken as the type. The writer has arbitrarily chosen for that purpose the form with numerous pinnae, which has a rather wider distribution than *A. vernicosa*. The specimen of the type collection (*Wright* 162) in the National Herbarium consists of a single fruiting branch of this form.

***Calliandra konzattii* Standl., sp. nov.**

Branches slender, grayish; petioles 6 to 12 mm. long; pinnae a single pair, the rachis slender, 2 to 4 cm. long, densely hirtellous; leaflets 5 or 7, ovate, elliptic, or elliptic-oblong, 2.2 to 6.2 cm. long, 1 to 2.5 cm. wide, the lower ones much smaller than the upper, rounded or very obtuse at the oblique base, usually acute but sometimes obtuse at the apex, subchartaceous, bright green, puberulent or hirtellous on the costa, but elsewhere glabrous, the venation prominulous; flowers capitate, sessile, the heads sessile, solitary, the bracts puberulent; calyx 1 mm. long, campanulate, puberulent; corolla 4 to 5 mm. long, greenish, sparsely puberulent above, the lobes very short, ovate, obtuse; stamen tube short-exserted.

¹ Pl. Wright. 1: 67. 1852.

Type in the U. S. National Herbarium, no. 763864, collected along the Río de Pilas, Distrito de Pochutla, Oaxaca, Mexico, altitude 300 meters, April 27, 1917, by C. Conzatti (no. 3191).

Not closely related to any species of *Calliandra* previously reported from Mexico. In the absence of fruit it is impossible to be certain that the plant is not a *Pithecollobium*, but if so it can not be referred to any of the described species.

***Leucaena cuspidata* Standl., sp. nov.**

Branches slender, subterete, reddish brown, glabrous; stipules 2 to 3 mm. long, ovate or deltoid-ovate, cuspidate; petioles 1.5 to 2.5 cm. long, with a depressed circular gland at the apex, the rachis 3 to 8 cm. long, glabrous, the pinnae 5 to 9 pairs, 4 to 7 cm. long, their rachises glabrous or at first sparsely pilose; leaflets 15 to 40 pairs, sessile, ovate-oblong, most of them about 4.5 mm. long and 2.2 mm. wide, obliquely rounded or truncate at the base, rounded or obtuse and cuspidate at the apex, coriaceous, glabrous, dark green on the upper surface, the venation plane or prominulous, much paler beneath, the venation prominent, the margin plane; peduncles axillary, 2 to 3.5 cm. long, glabrous, involuclate above the middle, the flowers sessile in a globose head 7 to 8 mm. in diameter; calyx 2 mm. long, shallowly dentate, glabrous or puberulent above; corolla 3 mm. long, glabrous; anthers short-exserted, glabrous; immature fruit sessile or nearly so, attenuate to the base, glabrous.

Type in the U. S. National Herbarium, no. 463766, collected at Minas de San Rafael, San Luis Potosí, Mexico, May, 1911, by C. A. Purpus (no. 5183).

The coriaceous, cuspidate leaflets, with prominent venation, are quite unlike those of any of the described species.

***Leucaena plurijuga* Standl., sp. nov.**

Branches brown, terete, minutely puberulent when young, furnished with numerous small pale lenticels; stipules deciduous; petioles 3.5 to 5 cm. long, minutely puberulent or glabrate, furnished near the base with a large depressed oblong gland, the rachis 3 to 9.5 cm. long, the pinnae 3 to 5 pairs, 5 to 10 cm. long, leaflets 5 to 9 pairs short-petiolulate, oblong or elliptic-oblong, sometimes oblong-obovate, usually subfalcate and asymmetric, 1.4 to 5.2 cm. long, 0.7 to 1.5 cm. wide, rounded and more or less oblique at the base, rounded or very obtuse at the apex and apiculate, chartaceous, green above, minutely appressed-pilose when young, the venation prominulous, paler beneath, sparsely and minutely pilose when young but soon glabrate, the venation prominent-reticulate, the margin plane; peduncles axillary, 3 to 3.5 cm. long in fruit; fruit oblong-linear, about 24 cm. long and 4.3 cm. wide, acute at the base, acuminate at the apex, glabrous, the valves thin, brown, the stipe about 2 cm. long; seeds about 1 cm. in greatest diameter, flat, brown, smooth, sublustrous.

Type in the U. S. National Herbarium, no. 246386, collected at Monte León, Michoacán, Mexico, November 12, 1892, by C. G. Pringle (no. 5352).

Also collected near Querétaro, August, 1906, by J. N. and J. S. Rose (no. 11173). A sterile specimen collected at Celaya, Guanajuato, in 1897, by J. N. Rose (no. 3073), is probably of this species.

Related to *Leucaena macrophylla* Benth. and *L. macrocarpa* Rose, both of which differ in their less numerous pinnae and leaflets.

***Pithecollobium leiocalyx* Standl., sp. nov.**

Younger branches brownish, puberulent at first, with numerous pale lenticels, furnished with few short stout straight ascending spines; petioles slender, 1.2 to 1.7 cm. long, with a small crateriform gland near the base, the rachis 6 to

14 mm. long, minutely pilose; pinnae 2 or 3 pairs, the leaflets 3 to 5 pairs, oval to broadly oblong, 7 to 14 mm. long, 3.5 to 7 mm. wide, rounded and oblique at the base, rounded at the apex, chartaceous or subcoriaceous, pilose with very short subappressed hairs or finally glabrate, green above, pale beneath, the margin plane; flowers capitate, sessile, the heads few-flowered, the peduncles 2.5 to 3 cm. long; calyx 7 to 8 mm. long, glabrous, the lobes oblong-ovate, variable in length, ciliate; corolla about 1.5 cm. long, copiously white-pilose above the calyx, the lobes lance-oblong, acute, about half as long as the tube; stamens very long, the tube exserted 1 to 1.5 cm.

Type in the U. S. National Herbarium, no. 567316, collected at Salina Cruz, Oaxaca, Mexico, April 28, 1910, by C. R. Orcutt (no. 3288).

Although the material at hand is rather imperfect, this plant seems sufficiently distinct to deserve recognition as a species. It is related, evidently, to *P. acatlense* Benth., but in that the calyx is densely pilose, the peduncles are very short, and the numerous leaflets are much smaller and proportionately narrower.

***Pithecollobium calostachys* Standl., sp. nov.**

Tree, 4.5 to 6 meters high or larger, the younger branches green or grayish, conspicuously lenticellate, pubescent at first, armed with numerous short, stout, ascending or subdivaricate spines; petioles 0.6 to 4.5 cm. long, slender, glabrous or nearly so, bearing a low gland at the apex; pinnae one pair, the rachis 0.6 to 2.5 cm. long, the leaflets a single pair to each pinna, oblique, ovate to oblong or oval-ovate, 3 to 11 cm. long, 1.3 to 6 cm. wide, rounded or obtuse at the base and very unequal, narrowed to the obtuse or acute apex, thick-chartaceous, bright green, glabrous or nearly so, the venation prominent or prominulous on both surfaces; inflorescence spicate, the spikes dense, 2.5 to 7.5 cm. long, on long or short peduncles, axillary or usually paniculate, the rachis densely puberulent, the bracts linear-lanceolate, 2 to 3 mm. long, divaricate or reflexed, puberulent; calyx 2.5 to 3 mm. long, tubular-campanulate, pilose with minute, mostly appressed hairs; corolla 5 to 6 mm. long, sericeous, the lobes oblong-ovate, acute, about half as long as the tube; stamen tube much exserted, usually twice as long as the corolla or longer; fruit curved or colled, glabrous, the valves 1.5 to 2 cm. wide, contorted after dehiscence, convex, very thick (6 to 8 mm.) and hard.

Type in the U. S. National Herbarium, no. 463247, collected in the vicinity of Tampico, Tamaulipas, Mexico, altitude about 15 meters, April, 1910, by Edward Palmer (no. 307).

The following additional specimens are in the National Herbarium:

TAMAULIPAS: Tampico, *Pringle* 7681; May, 1910, *Palmer*. Gómez Farias, *Palmer* 282.

SAN LUIS POTOSÍ: Tancanhuitz, alt. 360 meters, *Nelson* 4372. Without locality (perhaps from Tamaulipas), *Palmer* 1061.

VERACRUZ: Carrizal, *Goldman* 702, 703.

TABASCO: Mayito, *Rovtrosa* 112.

OAXACA: Chivela, *Orcutt* 3189.

CHIAPAS: Tapachula, *Nelson* 3852.

This plant has always been confused with *P. lanceolatum* (Humb. & Bonpl.) Benth. (*P. ligustrinum* Benth.), a species described from Venezuela. The latter ranges northward from Venezuela and Colombia to Mexico, but in Mexico it is confined chiefly to the west coast, while *P. calostachys* is most abundant on the east coast. *P. lanceolatum* is distinguished from the species here described as new by the very short, triangular bracts and the included or short-exserted stamen tube. Its leaflets, too, are usually more obtuse at the apex, and the

valves of the fruit, in the few fruiting specimens examined, are much narrower and thinner.

***Pithecollobium macrosiphon* Standl., sp. nov.**

Young branches green or gray, puberulent at first, roughened by numerous pale lenticels, furnished with short ascending straight spines; petioles stout, 1.5 to 4.8 cm. long, with a low crateriform gland at the apex; pinnae a single pair, the rachises 4 to 13 mm. long; leaflets a single pair, short-petiolate, the blades obliquely elliptic, elliptic-oblong, or elliptic-oval, 3 to 7 cm. long, 1.5 to 3.8 cm. wide, rounded or very obtuse at the base and unequal, obtuse or very obtuse at the apex, mucronulate, subcoriaceous, brownish, especially beneath, glabrous, the venation prominent or prominulous on both surfaces; flowers spicate, the spikes 5 to 6 cm. long, very dense, the bracts deltoid, minute; calyx 1 to 1.2 mm. long, campanulate, puberulent; corolla 6 to 6.5 mm. long, minutely sericeous, the lobes oblong-ovate, acute, about half as long as the tube; stamen tube exerted 11 to 15 mm.; valves of the fruit (a single imperfect fruit seen) 1.5 to 1.8 cm. wide, very thick and hard, somewhat contorted after dehiscence; seeds 1.2 to 1.5 cm. long, compressed, dark brown, with a very large fleshy aril.

Type in the U. S. National Herbarium, no. 252338, collected between Tumbala and El Salto, Chiapas, Mexico, October 29, 1895, by E. W. Nelson (no. 3398).

Related to *P. lanceolatum* (Humb. & Bonpl.) Benth., and to *P. calostachys*, described above, but distinguished from both by the very short calyx. The stamen tube, also, is much longer than in any of the related species.

***Pithecollobium confine* Standl., sp. nov.**

Densely branched shrub, 1 to 1.5 meters high, or sometimes a small tree, with very stout, grayish, flexuous or contorted branches, armed with numerous short stout straight spines; leaves clustered on short lateral spurs, the petiole 4 to 15 mm. long, puberulent, bearing a low gland at the apex between the lowest pair of pinnae, the pinnae usually one but sometimes 2 pairs, the rachis, if any, very short, the leaflets 3 to 5 pairs, oblong-oval to rounded-oval or broadly cuneate-obovate, 4.5 to 10 mm. long, 2.5 to 7 mm. wide, rounded or very obtuse at the unequal base, rounded to truncate at the apex, subcoriaceous, puberulent when young but usually soon glabrate, the venation commonly prominulous; inflorescence capitate, the heads globose, the peduncles mostly solitary and axillary, 5 to 10 mm. long, puberulent; calyx 1 to 1.2 mm. long, campanulate, puberulent; corolla 2.5 mm. long, purplish, the tube glabrous, the lobes ovate, obtuse, puberulent, less than half as long as the tube; stamens numerous, the tube included; fruit about 10 to 14 cm. long and 2.5 to 3 cm. wide, densely puberulent when young, black in age, the outer coat breaking into numerous irregularly angulate plates, the valves becoming very thick, hard, and woody, usually curved, convex, tardily separating; seeds usually 5 to 10, variously compressed, 10 to 18 mm. in greatest diameter, dark brown, smooth.

Type in the U. S. National Herbarium, no. 638396, collected at Cape San Lucas, Baja California, Mexico, March 23, 1911, by J. N. Rose (no. 16339).

The following additional specimens have been examined:

BAJA CALIFORNIA: Cape San Lucas and vicinity, *Xantus* 33. Los Angeles Bay, *Palmer* 548. La Paz, *Palmer* 86. San José del Cabo, *Rose* 16444. Catalina Island, *Rose* 16837. Cerralvo, *Rose* 16896. Agua Colorada to Cerro Colorado, *Nelson & Goldman* 7316.

This plant has been referred to *P. flexicaule* (Benth.) Coult., but in that the inflorescence is spicate and the pinnae are usually more numerous. The latter species is known in Mexico only from Tamaulipas and Nuevo León.

The common name is said to be "palo fierro."

TWO NEW SPECIES OF CALOPHYLLUM FROM MEXICO.

The genus *Calophyllum* of Linnaeus is composed of about 50 species, natives chiefly of tropical Asia and Africa. Vesque, in his monograph of the genus,¹ reports only four species from the Western Hemisphere: *C. calaba* Jacq., of the West Indies; *C. brasiliense* Camb., ranging from Brazil to Panama; *C. lucidum* Benth., of the Guianas; and *C. pachyphyllum* Triana & Planch., of Brazil. The recent discovery of two species in southern Mexico indicates that the range of the genus extends farther north than had been believed previously.

Calophyllum rekoi Standl., sp. nov.

Tree, 20 to 25 meters high, the branchlets stout, angulate and plicate-striate, pruinose-puberulent at first but soon glabrate, the internodes elongate; petioles stout, 2.2 to 3.2 cm. long, sulcate on the upper side, rounded beneath; leaf blades elliptic or narrowly elliptic-oblong, 10.5 to 16 cm. long, 4.3 to 6 cm. wide, obtuse or acute at the base, acutish or obtusely short-acuminate at the apex, coriaceous, lustrous above, the costa impressed near the base, prominent toward the apex, dull beneath, the costa salient, the lateral nerves very numerous, approximate, parallel, prominulous, the margin thickened; racemes axillary, mostly 7-flowered, 2.5 to 3.5 cm. long, short-pedunculate, the rachis and pedicels puberulent, the latter stout, 2.5 to 5 mm. long; bracts minute, caducous; polygamous flowers 8 mm. broad, the sepals 4, reflexed, oval, more or less cucullate, the 2 inner ones petaloid, the petals wanting; stamens 7 to 12, the anthers 1.5 to 2 mm. long; ovary globose, the stigma peltate, irregularly lobed.

Type in the U. S. National Herbarium, no 842605, collected at Cafetal Concordia (Cerro Espino), Oaxaca, Mexico, November 18, 1917, by B. P. Reko (no. 3557).

This species is related to *C. brasiliense*, but is distinguished by the long petioles (twice as long as the latter species) and by the puberulent inflorescence. The vernacular names are given as "cimarrón" and "cedro cimarrón."

Doctor Reko furnishes the following additional notes regarding the plant: "A most beautiful tree, about 20 to 25 meters high, growing very commonly here in nearly all the cafetales, at an altitude of about 600 to 800 meters, and highly appreciated on account of its excellent wood, which resembles mahogany. It is hardly possible to believe that such a tree should still be unknown in Mexico, and only the great difficulty in discovering the small, white flowers so high up in the foliage of the tree would account for it. The tree, when cut, produces a yellow, sticky sap, something similar to the 'chicle,' and is used as 'leche María' by the Indians. The flowers are very fragrant. The fruit is spheric, of the size of a walnut (4 to 5 cm.)."

Calophyllum chiapense Standl., sp. nov.

Branches thick, grayish, the branchlets very stout, pruinose-puberulent at first but soon glabrate, densely leafy; petioles stout, 8 to 10 mm. long, sulcate on the upper surface, rounded beneath; leaf blades elliptic or obovate-elliptic, 6.5 to 8.5 cm. long, 2.2 to 4 cm. wide, acute or cuneate at the base, obtuse or acutish at the apex, coriaceous, glabrous, lustrous above, the costa sulcate near the base, prominulous toward the apex, the lateral nerves very numerous,

¹ In DC. Monogr. Phan. 8: 529-610. 1893.

approximate, parallel, prominulous, slightly paler beneath and dull, the costa salient, the lateral nerves prominulous, the margin thickened; racemes axillary, mostly 5-flowered, short-pedunculate, about 2.5 cm. long, the rachis and pedicels obscurely puberulent, the latter 2 to 4 mm. long, stout, opposite, the bracts minute, deciduous; polygamous flowers 8 to 10 mm. broad, the sepals 4, more or less cucullate, minutely scaberulous on the margins; stamens numerous.

Type in the U. S. National Herbarium, no. 860362, collected at Los Pinos, near Tonalá, Chiapas, Mexico, December 13, 1906, by G. N. Collins and C. B. Doyle (no. 59).

Calophyllum chiapense is related to some of the forms of *C. brasiliense*, but is distinguished by the smaller, relatively narrower leaf blades, these being usually broadest slightly above the middle. In the latter species, too, the racemes are usually much longer and the flowers smaller.

The present species is known in Chiapas as "leche de María." The wood is used for making cart wheels.

THREE NEW SPECIES OF EBENACEAE FROM TROPICAL AMERICA.

In the last paper of this series the writer described five new species of *Maba* and *Diospyros* from Mexico. The three following ones are based upon additional material now available for study.

Maba nicaraguensis Standl., sp. nov.

Tree, 4.5 to 6 meters high, with a short trunk and dense rounded crown; branches grayish, the branchlets densely puberulent; petioles stout, 5 to 6 mm. long, densely fulvous-pilose with short hairs; leaf blades oblong or oblong-obovate, 5.5 to 8 cm. long, 2.2 to 3.3 cm. wide, rounded to cuneate at the base, obtuse or acutish at the apex, coriaceous, grayish green above, velvety-pilose with short grayish hairs, the costa plane, the lateral veins inconspicuous, brownish beneath, copiously pilose with short slender hairs, the costa and lateral veins prominent, the latter about 7 on each side, irregular, the transverse veins prominulous, laxly reticulate, the margin plane or subrevolute; fruit globose, about 2.2 cm. in diameter, umbonate, densely fulvous-sericeous near the apex, subsessile, solitary; calyx trilobate to the middle, about 2 cm. broad, densely fulvous-tomentulose, the lobes broadly rounded, reflexed.

Type in the U. S. National Herbarium, no. 862725, collected on dry hills, Granada, Nicaragua, February 16, 1903, by C. F. Baker (no. 629).

This is the first species of *Maba* to be reported from Central America. It is related, perhaps, to *M. albens* (Presl) Hiern, a species with thin leaves, canescent-tomentulose beneath.

Maba reko Standl., sp. nov.

Branchlets brown, rimose, densely fulvous-pilose when young with short hairs, glabrate in age; petioles stout, 4 to 5 mm. long, hirtellous; leaf blades oval or oval-oblong, 10 to 11 cm. long, 5 to 5.5 cm. wide, rounded at the base, very obtuse or rounded at the apex, chartaceous, bright green above, minutely pilose or glabrate, the costa impressed, grayish green beneath, minutely pilose with spreading hairs, the costa and lateral veins very prominent, the latter 6 or 7 on each side, arcuate, the transverse veins prominent, laxly reticulate, the margin subrevolute; fruit globose, 1.5 to 2 cm. in diameter, glabrous, short-pedunculate, solitary; calyx deeply 3-lobate, 1.5 to 2 cm. broad, densely puberulent, the lobes broadly rounded, reflexed.

Type in the U. S. National Herbarium, no. 842523, collected at Puerto Angel, Oaxaca, Mexico, September 28, 1917, by B. P. Reko (no. 3429).

The leaves are larger than in any other Mexican species. *Maba latifolia* Standl. is closely related but is distinguished by its small, coriaceous, rugose leaves.

***Diospyros oaxacana* Standl., sp. nov.**

Branches grayish, the branchlets slender, densely brownish-pilose, the pubescence persistent; petioles stout, 2 to 3 mm. long, densely pilose; leaf blades oblong, obovate-oblong, or elliptic-oblong, 4 to 7.5 cm. long, 2.8 to 4 cm. wide, rounded or obtuse at the base, rounded at the apex, chartaceous, green above, velutinous-pilose with short hairs or in age glabrate, paler beneath, densely short-pilose, the margin subrevolute; pistillate flowers solitary, the fruiting peduncles about 1 cm. long; pistillate calyx 5-parted to the base, short-pilose, the lobes linear-oblong, 1 to 1.5 cm. long, widest toward the apex, obtuse or rounded; immature fruit subglobose, 1.5 cm. in diameter, glabrous.

Type in the U. S. National Herbarium, no. 381771, collected at Cuicatlán, Oaxaca, Mexico, altitude 600 meters, September 16, 1899, by V. González (no. 982).

Because of the glabrous fruit it is probable that this species belongs to the section *Danzleria*. Two Mexican species, *D. palmeri* Eastw. and *D. blepharophylla* Standl. (*D. ciliata* A. DC.), have glabrous fruit (and ovary), but they differ from the present plant in having glabrous leaves.

THE PANAMANIAN SPECIES OF LEIPHAIMOS.

The species of this genus form one of the most interesting groups of tropical American plants. They are parasites or saprophytes, without chlorophyll, resembling in general appearance the Orobanchaceae or even some of the saprophytic Orchidaceae and Burmanniaceae. They have a comparatively simple structure, but vary widely in the form of the flowers, the shape of the corolla and calyx and the structure of the stamens affording excellent characters for specific segregation. The flowers are usually small, the largest, perhaps, being those of one of the Panamanian species, *L. pulcherrimus*, whose corolla has a length of nearly 3.5 cm. and a breadth of 2 to 2.5 cm. The corolla is commonly bright-colored, of various shades of blue, yellow, or purplish red, but is often white or cream-colored.

Until recently the species of *Leiphaïmos* have been included in the genus *Voyria*. The treatment adopted here is that followed by Gilg in his account of the Gentianaceae in Engler and Prantl's *Natürlichen Pflanzenfamilien*.¹ *Voyria*, as limited by Gilg, is characterized by the dehiscence of the capsule, which is apical rather than lateral as in *Leiphaïmos*. In the former the pollen grains are elongate and curved, while in *Leiphaïmos* they are ovoid. Gilg remarks that the two genera are far removed from each other in many points. To *Voyria* Gilg refers 3 species, all from the Guianas. These form a homogeneous group, closely resembling one another in habit.

¹ 4: 50-108. 1895.

Leiphaimos was based by Schechtendal and Chamisso in 1831 upon a plant collected by Schiede and Deppe upon rotten logs in the forests of Papantla, Mexico. The original species, *Leiphaimos parasiticus*, has the most northern range and possibly the widest distribution of any plant of the genus, occurring from southern Mexico to the West Indies and the keys of Florida. Five other generic names have been published which, for the present, are considered synonyms of *Leiphaimos*. *Ciminalis* of Rafinesque¹ contained 3 species which are said to be synonyms of *Leiphaimos aphyllus*, the earliest published species of the group, described by Jacquin in 1760 as *Gentiana aphylla*.²

Leianthostemon of Miquel³ was based upon two closely related species with corymbose inflorescence. Miquel describes two other genera at the same time, *Disadena*⁴ and *Pneumonanthopsis*.⁴ The first, under which he described a single species, *D. flavescens*, is the name to be used for those species having glanduliferous ovaries, should it ever be deemed necessary to resegment them as a distinct genus. *Pneumonanthopsis* consisted of two species of rather diverse form. *Biglandularia* of Karsten,⁵ like *Disadena*, was based upon a plant with gland-bearing ovaries, *B. azurea* (*Leiphaimos azureus* Gilg), one of the species listed here from Panama.

It seems to the writer that it will probably be necessary later to resurrect some of these names and to form several additional genera. The plants composing the genus vary greatly in general appearance as well as in floral structure, variations more conspicuous than those separating most of the genera of the Gentianaceae. So little material exists in herbaria, however, and this often incomplete, that it does not seem wise to attempt generic segregations at present. From the nature of the plants the species must have a localized distribution, and few of them are known from more than a single collection. They are said to be represented by only a few individuals, and these usually widely separated, in a given locality.

Leiphaimos has a rather wide distribution in tropical America, extending from Mexico and the keys of Florida, through the West Indies, to Bolivia and central Brazil. Two species have been described from tropical western Africa.⁶

There is at least one good monograph of the genus, and many of the species have been illustrated. Grisebach, in his *Genera et Species Gentianearum*, in 1839, lists seven species, with keys and descriptions. In the next year Splitgerber published a revision of the group, de-

¹ Fl. Tellur. 3: 19. 1836.

² Enum. Pl. Carib. 17.

³ Stirp. Surin. Sel. 147. 1850.

⁴ Stirp. Surin. Sel. 150. 1850.

⁵ Linnaea 28: 416. 1856.

⁶ Baker, Kew Bull. 1894: 25, 26. 1894.

scribing four new species,¹ which are well illustrated with hand-colored plates. The best monograph of *Voyria* (including *Leiphaimos*) is that of Progel in Martius's *Flora Brasiliensis*,² where twenty-one species are keyed and described, and six figured. Gilg, in Engler and Prantl's *Natürlichen Pflanzenfamilien*,³ divides the genus into five sections or subgenera, under which he enumerates most of the species, seven of which are figured.

Of the eight species here listed from Panama, six are described as new. The large number of new forms is not remarkable, since the material studied comes from a more northern region than any in which a considerable number of species have been collected. One species, described from Panama by Griesbach, is known to the writer only from description, while two Panamanian specimens seem to belong to a species described by Karsten from Venezuela.

KEY TO THE SPECIES.

Calyx limb wanting. Corolla blue, the tube 3 times as long as the lobes; scales one on each stem-----7. *L. simplex*.

Calyx limb present.

Ovary bearing 2 stipitate glands at the base; corolla blue-----8. *L. azureus*.

Ovary without glands; corolla not blue.

Corolla lobes obtuse.

Filaments many times longer than the anthers; flowers long-pedunculate; corolla tube gradually dilated upward-----6. *L. pulcherrimus*.

Filaments about as long as the anthers; flowers sessile; corolla tube cylindric, slightly dilated in the throat-----1. *L. truncatus*.

Corolla lobes acute.

Flowers numerous, in a compact terminal corymb-----4. *L. albus*.

Flowers solitary, or few and the stems fastigiate branched.

Anthers appendaged at the base; stems fastigiate branched at the base-----5. *L. thalesioides*.

Anthers not appendaged; stems usually simple and one-flowered.

Anthers sessile; corolla tube twice as long as the calyx or shorter-----2. *L. stellatus*.

Anthers on long slender filaments; corolla tube 3 times as long as the calyx-----3. *L. pittieri*.

1. *Leiphaimos truncatus* Standl., sp. nov.

Stems very stout, erect, 3 to 3.5 cm. high, fasciculately branched at the base, the branches simple or again branched, closely covered with scales but these not imbricate; scales opposite, 3 to 5 mm. long, rounded or acutish at the apex, connate for half or two-thirds their length, the sinus between the two bracts very broad, the bracts ascending; pedicels very short, 4 mm. long or less, 1.5 mm. thick; calyx cylindric-campanulate, 6 mm. long, 3.5 mm. in diameter, the 5 teeth broadly ovate, obtuse, minutely ciliolate, scarcely 1 mm. long; corolla apparently pale yellow, the tube cylindric, 3 cm. long, 2.5 mm.

¹ Tijdschr. Nat. Gesch. 7: 129-139. pls. 1, 2. 1840.

² 6¹: 219-226. pl. 60, figs. 3-5, pl. 61, figs. 1-3. 1865.

³ 4²: 104-105. fig. 46. A-M, S-Y. 1895.

in diameter, slightly dilated above but somewhat contracted at the mouth; corolla lobes 5, spreading or ascending, oblong, obtuse, 7 mm. long; filaments stout, about 1 mm. long, inserted 3 mm. below the mouth of the corolla; anthers almost rotund in outline, deeply bilobate, exappendiculate; style slender, 2.2 cm. long; stigma capitate, 1.5 mm. broad, obscurely papillose on the upper surface, smooth beneath; ovary sessile, oblong in outline, rounded at the base, truncate at the apex; ovules ovoid, not appendaged.

Type in the U. S. National Herbarium, no. 888489, collected on the high hills back of Puerto Obaldía, San Blas Coast, Panama, altitude 50 to 200 meters, August, 1911, by H. Pittier (no. 4306a).

Of the subgenus *Euleiphaimos* Gilg and related to *L. spathaceus* and *L. calycinus*. Both these species have blue or lilac corollas with acute lobes and more foliaceous, less completely connate cauline bracts. *Leiphaimos truncatus* may be distinguished from all other species by the truncate ovary. The type material is fragmentary, but it is sufficient to show all the important characters.

2. *Leiphaimos stellatus* Standl., sp. nov.

Stems very slender, erect, 1-flowered, succulent, terete, pinkish, glabrous, 4 to 12 cm. high; bracts opposite, 4 or 5 pairs, distant, oblong-linear or lance-oblong, 5 to 8 mm. long, with long-acuminate subulate tips, united for about half their length; peduncles slender, 11 to 23 mm. long; calyx pinkish or nearly colorless, ebracteate, 5 to 12 mm. long, 5-lobate to about the middle, the tube cylindric-campanulate, 1 to 2 mm. in diameter, the lobes linear-lanceolate, long-acuminate, with subulate tips; corolla bright orange-yellow, the tube slender, cylindric, 12 to 17 mm. long, slightly dilated in the throat, the lobes narrowly lanceolate to narrowly elliptic, 8 to 14 mm. long, 1.5 to 3 mm. wide, acuminate, rather conspicuously parallel-nerved, especially in old specimens, puberulent on the upper surface near the base, the pubescence extending to the throat of the tube; anthers subsessile, oblong, distinct, not appendaged; style slender, 6 to 8 mm. long, glabrous; stigma capitate, minutely tuberculate on the upper surface; ovary oblong, abruptly acute or acuminate, sessile; ovules ovoid.

Type in the U. S. National Herbarium, no. 679407, collected in forests around Puerto Obaldía, San Blas Coast, Panama, altitude 50 meters or less, August, 1911, by H. Pittier (no. 4294).

This belongs to Gilg's subgenus *Euleiphaimos*, and is closely related to *L. tenuiflorus* (Griseb.) Miquel. That species, however, has a short calyx, only one-fourth as long as the corolla tube, and subulate cauline scales.

3. *Leiphaimos pittieri* Standl., sp. nov.

Stems very slender, 5 to 12 cm. high, erect, terete, glabrous, purplish, simple or once dichotomous above, the branches when present strictly erect; cauline bracts 4 or 5 pairs, distant, lanceolate or linear-lanceolate, acuminate to a subulate tip, 5 mm. long, erect or appressed, purplish, free nearly to the base; peduncles slender, 6 to 14 mm. long; calyx purple, ebracteate, cleft about half-way to the base, 5 mm. long, 1.5 mm. in diameter, the tube narrowly campanulate, the lobes lanceolate or lance-linear, long-acuminate to a subulate tip; corolla lilac or pale blue, the tube very slender, 14 to 16 mm. long, slightly dilated in the throat and there 3 to 4 mm. wide; corolla lobes narrowly oblong or oblong-lanceolate, acuminate or abruptly acuminate, 5 to 6 mm. long; anthers narrowly oblong, 1 mm. long, not appendaged, on very slender, slightly puberulent filaments, these inserted about one-third the distance above the base of the tube; style slender, 12 mm. long, puberulent; stigma capitate, slightly tuberculate on the upper surface; ovary oblong or lance-oblong in outline, 2.5 mm. long, obtuse, sessile; ovules ovoid, not appendaged.

Type in the U. S. National Herbarium, no. 679405, collected in the forests around Puerto Obaldía, San Blas Coast, Panama, altitude 50 meters or less, August, 1911, by H. Pittier (no. 4292).

Of the subgenus *Euleiphaimos*, but not closely related to any of the described species. The blue corolla and long filaments enable one to distinguish it readily.

4. *Leiphaimos albus* Standl., sp. nov.

Whole plant white; stems slender, erect, sometimes decumbent at the base, 6 to 14 cm. high, succulent, terete, glabrous, simple up to the inflorescence, or rarely with a short erect branch; cauline scales 4 or 5 pairs, 2 to 4 mm. long, distinct almost to the base, lanceolate, long-acuminate; inflorescence a several or many-flowered terminal flat-topped corymb, 1.2 to 3 cm. broad, 1.5 to 3 cm. high, the flowers all sessile or the terminal one short-pedicel; bracts usually present at the base of each branch and commonly 2 at the base of the calyx, small, thin, lanceolate, acuminate; calyx 3 to 4 mm. long, cleft halfway to the base, the tube campanulate, the lobes linear-subulate, the sinuses obtuse; corolla tube slender, cylindric, dilated in the throat, 10 mm. long, about 1 mm. thick; corolla lobes 5, ascending or spreading, triangular-lanceolate, 2 to 2.5 mm. long, acute or acuminate; anthers subsessile, oblong, 1.25 mm. long, deeply bilobate, each lobe prolonged at the base into a short subulate appendage; style slender, 3 mm. long; stigma capitate, 0.75 mm. in diameter, yellowish, tuberculate on the upper surface; ovary 6 mm. long, linear-lanceolate in outline, gradually tapering upward.

Type in the U. S. National Herbarium, no. 679408, collected in forests around Puerto Obaldía, San Blas Coast, Panama, altitude 50 meters or less, August, 1911, by H. Pittier (no. 4295).

ADDITIONAL SPECIMEN EXAMINED:

PANAMA: In forests, Loma de la Gloria, near Fató (Nombre de Dios), Province of Colón, alt. 10 to 100 meters, August, 1911, Pittier 4094.

This is undoubtedly a member of the subgenus *Leianthostemon*. That group has been described as having long filaments, but the discovery of this plant necessitates a modification of its characterization in this respect. *Leiphaimos albus* is related to *L. corymbosus* (Splitg.) Gilg, a species with a lilac corolla and long anthers.

5. *Leiphaimos thalesioides* Standl., sp. nov.

Stems fastigiately branched at the base, the branches simple up to the inflorescence or with one or two erect branches, purplish yellow, terete, succulent, glabrous; cauline scales usually 3 pairs, distant, thin, distinct nearly to the base or sometimes united for half their length, lanceolate or lance-ovate, acuminate to a subulate apex, glabrous; inflorescence a congested terminal corymb, composed of about 6 flowers, or the corymb sometimes fastigiately branched; pedicels stout, 2 to 4 mm. long, subtended at the base by bracts similar to those of the stems; calyx 5 mm. long, ebracteate, cleft halfway to the base, the tube campanulate, 2 to 2.5 mm. in diameter, the lobes linear-lanceolate, long-acuminate, glabrous; corolla yellow, the tube 13 to 16 mm. long, slender-cylindric, 1 to 1.5 mm. in diameter, dilated in the throat; corolla lobes 4 mm. long, oblong, acute or abruptly acute, more or less puberulent; anthers subsessile, oblong, appendaged at the base; style 6 mm. long, rather stout, glabrous; stigma capitate, 1 mm. in diameter, coarsely tuberculate on the upper surface; capsule narrowly oblong, sessile, acute, 5 to 7 mm. long.

Type in the U. S. National Herbarium, no. 679499, collected on the hills of Sperdl, near Puerto Obaldía, San Blas Coast, Panama, altitude 20 to 200 meters, September, 1911, by H. Pittier (no. 4351).

This, like *L. albus*, is a somewhat anomalous representative of the subgenus *Leianthostemon*, differing from the described species of that group in its sessile anthers. It is not very closely related to any of them in its other characters.

6. *Leiphaimos pulcherrimus* Standl., sp. nov.

Stems slender, simple below, sparsely fastigiate-branched above, erect, 8 to 13 cm. high, the branches erect, terete, purplish; scales of the stem opposite, the pairs 8 to 17 mm. apart, rather thick, broadly oblong or oblong-oval, rounded or obtuse at the apex and ciliolate, united for about half their length; peduncles slender, 13 to 22 mm. long; calyx ebracteate, purplish, narrowly campanulate, 5 to 6 mm. long, 2.5 to 3 mm. in diameter, the 5 teeth broadly ovate or semi-orbicular, rounded at the apex, ciliolate, about 1 mm. long; corolla bright yellow, the tube 2.1 to 2.6 cm. long, gradually dilated from above the base to the mouth, about 2 mm. in diameter at the base and 5 to 7 mm. at the mouth, minutely papillose within, the lobes 5, oval or oval-oblong, rounded at the apex and minutely puberulent, about 9 mm. long and 5 to 6 mm. wide, spreading, papillose at the base; filaments slender, inserted about 1 cm. above the base of the corolla, about 15 mm. long, minutely retrorse-pilose; anthers narrowly oblong, 2 mm. long, with short slender appendages at the base, coherent; pollen grains ovoid; style slender, 16 mm. long, glabrous; stigma capitate, short-conic, 1.5 mm. broad, nearly smooth on the upper surface; ovary sessile, narrowly oblong, 6 to 7 mm. long, obtuse at the apex.

Type in the U. S. National Herbarium, no. 679430, collected on the high hills back of Puerto Obaldía, San Blas Coast, Panama, altitude 50 to 200 meters, August, 1911, by H. Pittier (no. 4306).

This doubtless belongs to the subgenus *Leianthostemon*, of which four species are known. It has little to do with any of the described species of this group, however, differing from all of them in its fastigiate branched stems, obtuse calyx lobes, long filaments, and large flowers of peculiar form. It has larger flowers, probably, than any other species of the genus.

7. *Leiphaimos simplex* (Griseb.) Standl.

Voyria simplex Griseb. in Seem. Bot. Voy. Herald 170. 1854.

TYPE LOCALITY: Woods near Ancón Hill, Panama; type collected by Seemann (no. 665).

Stem simple, slender, one-flowered, with a solitary abbreviated scale inserted at the middle; bracts and calyx limb none; corolla salverform, its cylindric-campanulate tube twice longer than the oblong obtuse blue lobes; ovary short-stipitate.

This species is not represented in the recent collections. According to Hemsley¹ it was collected also by Hayes (no. 236) in damp woods near Empire Station. The species is said by Grisebach to be closely related to *Voyria nuda*, a plant described by Splitgerber from Surinam.² The latter belongs to the subgenus *Disadena*, but Grisebach does not indicate that the ovary of *Voyria simplex* is glanduliferous; so perhaps it may not belong to this group.

8. *Leiphaimos azureus* (Karst.) Gilg in Engl. & Prantl, Pflanzenfam. 4²: 105. 1895.

Biglandularia azurea Karst. Linnaea 28: 417. 1856.

TYPE LOCALITY: "Crescit locis humidis umbrosis, altitudine 1,000 metr. radicibus Galactodendri adhaerens ad pedem septentrionalem montis 'Cumbre de Valencia' prope Puerto Cabello," Venezuela.

¹ Biol. Centr. Amer. Bot. 2: 344. 1882.

² Tijdschr. Nat. Geschied. Phys. 7: pl. 1, fig. 2. 1840.

RANGE: In damp or wet woods, Panama to Venezuela.

ILLUSTRATION: Engl. & Prantl, Pflanzenfam. 4²: fig. 46, L, M.

SPECIMENS EXAMINED:

PANAMA: Loma de la Gloria, near Fató (Nombre de Dios), Province of Colón, near sea level, Pittier 4081. Forests around Puerto Obaldía, San Blas Coast, near sea level, Pittier 4293.

This species is distinguished from all others so far found in Panama by the presence of two small but conspicuous stipitate glands at the base of the ovary. It is upon this character that Karsten based his generic name *Biglandularia*. It is very probable that when more complete material of the various members of the genus has been secured, it will be found that *Disadena*, which antedates *Biglandularia*, is a valid genus. Four species of this section are known, but they do not form a homogeneous group. One of them has no calyx, while of the other three two have appendaged anthers and one has unappendaged ones.

Leiphaimos azureus is a slender plant with few or numerous slender, very succulent stems, each of which is furnished with two or several pairs of thin bracts. The roots often form a dense mass, and are fleshy and knotted. The flowers are small, the corolla limb being about 1 cm. broad, resembling those of some species of *Primula*. The resemblance of the corolla to those of some of the primroses led Baker to apply the name *primuloides* to one of the African species.¹

A NOTE CONCERNING THE GENUS *RANDIA*, WITH DESCRIPTIONS OF NEW SPECIES.

The genus *Randia* is one of the larger groups of the family Rubiaceae and is represented in North America by about 40 species. Other members of the genus occur in South America, and a still larger number in the tropics of the Old World. The group is not a particularly well-marked one, being very closely related to *Gardenia*. Indeed, most of the genera of the tribe Gardenieae are separated by rather artificial characters.

In 1873 Hooker² removed from *Randia* a group of American species, associating them in a new genus which he named *Basanacantha*. *Randia* was limited to the species with perfect flowers, the flowers of *Basanacantha* being dioecious. The latter group was characterized also by certain habital peculiarities, none of them of very great importance. As the genus *Basanacantha* was originally delimited it included a homogeneous group of species, but Urban later added two West Indian plants of very different habital characters, plants which in general appearance are very like the common species of *Randia* proper. After study of all the North American species it seems to the writer that the two genera are separated by too artificial a character, and that they should be united. The species of *Basanacantha* listed below are, therefore, transferred to the genus *Randia*. For the other North American species of the group the proper combinations have already been made.

¹ Kew Bull. 1894: 26. 1894.

² In Benth. & Hook. Gen. Pl. 2: 82.

Randia cinerea (Fernald) Standl.

Genipa (?) *cinerea* Fernald, Proc. Amer. Acad. 33: 93. 1897.

Randia lasiantha Standl.

Basanacantha lasiantha Standl. Contr. U. S. Nat. Herb. 18: 134. 1916.

Randia pittieri Standl.

Basanacantha pittieri Standl. Contr. U. S. Nat. Herb. 18: 134. 1916.

Randia portoricensis (Urban) Standl.

Basanacantha portoricensis Urban, Symb. Antill. 5: 507. 1908.

Randia spinifex (Roem. & Schult.) Standl.

Ehretia spinifex Roem. & Schult. Syst. Veg. 4: 806. 1819.

Gardenia sagracana A. Rich. in Sagra, Hist. Cuba 11: 10. 1850.

Randia subcordata Standl.

Basanacantha subcordata Standl. Contr. U. S. Nat. Herb. 18: 133. 1916.

Randia calycosa Standl., sp. nov.

Unarmed tree, 3 to 10 meters high, the branches grayish, the branchlets stout, densely leafy; stipules 2 to 3 mm. long, rounded-ovate, mucronate, brown, glabrous; petioles 2 to 5 mm. long, glabrous; leaf blades obovate, elliptic-ovate, or oblong-elliptic, 3.5 to 6.5 cm. long, 1.5 to 2.8 cm. wide, attenuate or acuminate at the base, acute or acutish at the apex, chartaceous, glabrous above, lustrous, the venation prominulous, slightly paler beneath, sparsely pilose along the costa with long whitish appressed hairs or glabrate, the lateral veins inconspicuous, usually 4 on each side, the margin plane or subrevolute; flowers perfect (?), terminal, solitary, sessile, 5-parted; calyx tube and limb 1.4 cm. long, densely sericeous-strigose, the lobes foliaceous, rhombic-orbicular, subapiculate, 6 to 9 mm. long and broad, sparsely strigose outside, glabrous within; corolla salverform, the tube 2.7 to 3.2 cm. long, sericeous-strigose outside, the lobes lance-oblong, 1.7 to 2.5 cm. long, acute, glabrate outside, glabrous within, the throat naked; anthers included; fruit oval-globose, 3 to 3.8 cm. long, 2 to 2.5 cm. thick, smooth or obscurely costate, sparsely strigillose or glabrate, the pericarp very thick and hard; seeds numerous, rhombic-orbicular, 8 to 9 mm. long.

Type in the U. S. National Herbarium, no. 677593, collected in humid forest around Los Sigüas Camp, southern slope of Cerro de la Horqueta, Chiriquí, Panama, altitude about 1,700 meters, March, 1911, by H. Pittier (no. 3198).

A very distinct species, not closely related to any other described from North America. The broad, foliaceous calyx lobes are the most noteworthy character.

Randia laevigata Standl., sp. nov.

Unarmed shrub, about 2 meters high, the branchlets brownish, rimose, glabrous or sparsely puberulent when young, the internodes often elongate; stipules connate at the base, triangular-ovate, about 1 cm. long, acute, cuspidate-mucronate, thick, glabrous or puberulent outside, glabrous within; leaves sessile or short-petiolate, the blades obovate-oblong or rhombic-ovate, 14 to 23 cm. long, 5 to 8.5 cm. wide, acuminate or long-attenuate at the base, acute or acuminate at the apex, chartaceous or membranaceous, bright green and lustrous above, puberulent when young, glabrate in age, the venation plane or impressed, paler beneath, densely and minutely pilose when young, glabrate in age except along the veins, the lateral veins prominent, 10 to 13 on each side, nearly straight, ascending at an angle of 45° or more; calyx glabrous, the tube prolonged beyond the ovary, the 5 lobes triangular-subulate, 2 to 3 mm. long; fruit subglobose, about 6.5 cm. long, umbonate, glabrous, borne on a terminal peduncle about 3.5 cm. long; seeds oval or suborbicular, 8 to 10 mm. long, yellowish brown.

Type in the U. S. National Herbarium, no. 635870, collected in the Sierra de Álamos, Sonora, Mexico, March 18, 1910, by J. N. Rose, P. C. Standley, and P. G.

Russell (no. 13051). Specimens from Acaponeta, Tepic, collected in 1897 by J. N. Rose (nos. 1488 and 3166) apparently belong here also.

Randia laevigata appears to be related to *R. formosa* (Jacq.) K. Schum., but the latter is well distinguished by its small leaves, sericeous-strigose ovary, and small fruit.

***Randia pleiomeris* Standl., sp. nov.**

Branches slender, brownish, strigose when young, with mostly elongate internodes, bearing few pairs of stout ascending spines 1 to 1.5 cm. long, the leaves crowded on very short lateral spurs; stipules ovate-deltoid, about 2 mm. long, strigose or glabrous outside, pilose within at the base; petioles slender, 4 to 8 mm. long, glabrous or sparsely puberulent; leaf blades cuneate-orbicular or broadly obovate, 0.8 to 1.8 cm. long, 0.7 to 1.3 cm. wide, cuneate or abruptly decurrent at the base, rounded or truncate at the apex, membranaceous, glabrous above, sparsely appressed-pilose beneath along the costa, the lateral veins obscure; flowers terminal, solitary, sessile; calyx tube appressed-pilose, 2.5 mm. long, the limb glabrous, 2 mm. long, the lobes usually 7, linear, about 4 mm. long, sparsely ciliate; corolla salverform, glabrous outside, the tube slender, 2.5 cm. long, the 5 lobes ovate or ovate-oblong, about 1 cm. long, acuminate, glabrous within, the throat naked; anthers subexserted.

Type in the U. S. National Herbarium, no. 888490, collected at Santa Rosa, Guatemala, altitude 900 meters, May, 1892, by Heyde and Lux (J. D. Smith, no. 3166, in part).

The type collection was distributed as "*Randia Xalapensis*, Mart. et Gal.," with the note, "Flores steriles pollicares et ultra, fertiles vix 4-lineares." It is evident, however, that two distinct plants, not closely related, have been confused. *Randia pleiomeris* is the plant with large flowers. It appears to be related to *R. longiloba* Hemsl., of Yucatán, but in the latter the tube of the corolla is only as long as the lobes and the leaves are glabrous beneath.

***Randia guatemalensis* Standl., sp. nov.**

Branches reddish brown, the branchlets stout, subdivaricate, densely puberulent when young, bearing at the apex 2 stout spines 4 to 8 mm. long, the leaves fasciculate in the axils; stipules ovate-deltoid, 1 to 1.5 mm. long, mucronate, strigillose outside; petioles 1 to 11 mm. long, scaberulous or glabrate; leaf blades mostly oblong-elliptic, sometimes elliptic, broadly obovate, broadly ovate, or suborbicular, 0.6 to 5.5 cm. long, 0.6 to 2.8 cm. wide, rounded to attenuate at the base, usually obtuse or acutish at the apex, often mucronulate, subcoriaceous, lustrous above, the costa prominent, puberulent along the costa, paler beneath, minutely pilose along the costa, the lateral veins obscure, 5 to 8 on each side, the margin plane; flowers perfect, 5-parted, axillary, solitary, sessile; calyx 1.5 mm. long, scaberulous, the lobes minute, triangular-subulate, less than half as long as the limb; corolla 4 to 5 mm. long, glabrous outside, acuminate in bud, the tube cylindric, the throat densely white-barbate, the lobes broadly ovate, apiculate, shorter than the tube; anthers subexserted.

Type in the U. S. National Herbarium, no. 472930, collected near Secanquim, Alta Verapaz, Guatemala, altitude 550 meters, May, 1905, by H. Pittier (no. 271).

Related to *Randia erythrocarpa* Krug & Urban, of Haiti, and *R. mitis* L. (*R. aculeata* L.), a widely distributed species of tropical America. The former differs in its large corolla, and the latter in its long corolla lobes.

***Randia malacocarpa* Standl., sp. nov.**

Shrub, about 1 meter high, the branches dark reddish brown or grayish, the branchlets divaricate, stout, short-pilose when young, bearing at the apex 2 stout spines 0.6 to 1.5 cm. long, the leaves mostly crowded on very short

lateral spurs; stipules ovate, acuminate, 1 to 2 mm. long, thick, brownish, glabrous or short-pilose outside, glabrous within; petioles stout, 3 mm. long or shorter, short-pilose; leaf blades mostly ovate, ovate-oblong, or narrowly elliptic-oblong, rarely rounded-obovate, 2.5 to 5.5 cm. long, 0.8 to 2.5 cm. wide, acute to long-attenuate at the base, or rounded or obtuse and short-decurrent, usually acute at the apex, sometimes obtuse or rounded, often subapiculate, membranaceous or chartaceous, puberulent or scaberulous above, densely short-pilose beneath, the lateral veins inconspicuous, 3 to 5 on each side; flowers perfect, terminal, sessile, solitary or clustered; calyx densely short-pilose, the tube about 2 mm. long, the 5 lobes linear or oblong, 1 to 1.5 mm. long, acute or obtuse, spreading; corolla salverform, sparsely hirtellous outside, the tube 3 to 4 mm. long, ampliate above, the 5 lobes rounded, 2 to 3 mm. long, glabrous within, the throat naked; anthers subexserted; fruit globose, 1.2 cm. in diameter (or larger?), smooth, densely velvety-pilose, the pericarp very thick and hard; seeds numerous.

Type in the U. S. National Herbarium, no. 302274, collected near Acaponeta, Tepic, Mexico, July 30, 1897, by J. N. Rose (no. 3298).

The following additional specimens belong here:

SINALOA: Mazatlán, in thickets, April, 1910, *Rose, Standley & Russell* 13833.

Rosario, April, 1910, *Rose, Standley & Russell* 14526.

TEPIC: Acaponeta, July, 1897, *Rose* 1514; April, 1910, *Rose, Standley & Russell* 14454.

Allied to *R. xalapensis* Mart. & Gal., but easily recognized by the copious spreading pubescence of the fruit.

Randia rosei Standl., sp. nov.

Branches brownish, with short internodes, short-pilose when young with appressed hairs, armed with numerous pairs of stout divergent spines 1 to 2 cm. long, the leaves mostly crowded on very short lateral spurs; stipules about 2 mm. long, rounded-ovate, obtuse, mucronate, thick, brownish, glabrous; petioles slender, 1 to 5 mm. long, ciliate; leaf blades suborbicular, rhombic-oval, or rhombic-ovate, 1 to 2.5 cm. long, 0.7 to 1.8 wide, rounded or obtuse at the base and short-decurrent, rounded or very obtuse at the apex, sometimes apiculate, herbaceous, bright green, ciliate, short-pilose beneath along the veins, elsewhere glabrous, the lateral veins inconspicuous, 5 or 6 on each side, ascending or subdivaricate; flowers perfect, terminal, solitary, sessile; calyx tube about 2 mm. long, pilose, the 5 lobes linear, 3 to 6 mm. long, ciliate; corolla salverform, glabrous outside, the tube 10 to 12 mm. long, ampliate above, the throat naked, the 5 lobes ovate-oval, 8 mm. long, 5 to 7 mm. wide, obtuse or acutish, apiculate, glabrous within; anthers 1.5 to 2 mm. long, included; fruit (very immature) subglobose, rather sparsely pilose.

Type in the U. S. National Herbarium, no. 300395, collected at Rosario, Sinaloa, Mexico, July 7, 1897, by J. N. Rose (no. 1551).

Near *R. canescens* Greenm., a species with densely pilose leaves and pilose corolla.

NINE NEW SPECIES OF HOFFMANNIA FROM MEXICO AND CENTRAL AMERICA.

Hoffmannia obtains its greatest development in North America. Recent monographic study indicates that at least 33 species occur on this continent, chiefly in Mexico and Central America, only two being natives of the West Indies. They must be of very local distribution,

for it is unusual to find in herbaria more than two or three specimens of any species.

Hoffmannia rotundata Standl., sp. nov.

Branchlets stout, subterete, glabrate, the internodes elongate; leaves opposite, the petioles stout, 1.5 to 3 cm. long, sparsely villosulous or glabrate, the blades broadly oval-elliptic, 10.5 to 16 cm. long, 6 to 7.5 cm. wide, acutish or short-acuminate at the base, very obtuse to acute at the apex and short-acuminate, membranaceous, dark green above, glabrous, paler beneath, ferruginous-villosulous, especially along the veins, the costa very stout, prominent, the lateral veins slender, strongly arcuate, about 12 on each side; cymes dense, sessile, with numerous flowers, these sessile or short-pedicellate; calyx sparsely ferruginous-villous or glabrate, 2 to 2.5 mm. long, the tube turbinate, angulate, the lobes deltoid, acute, shorter than the tube; corolla 6 to 8 mm. long, glabrous or with a few scattered hairs, the lobes lance-oblong, acutish, twice as long as the tube.

Type in the herbarium of the Missouri Botanical Garden, no. 765057, collected on Cerro del Boquerón, Chiapas, Mexico, June, 1914, by C. A. Purpus (no. 7268, in part).

Of the previously described species, *H. tuerckheimii* Donn. Smith, of Guatemala, is most closely related to the present plant. That species, however, has a long-villous corolla, fewer flowers, and subcoriaceous leaves.

Purpus's no. 7268 is evidently a mixture. Specimens of this collection in other herbaria are referred to *Hoffmannia chiapensis*, described below.

Hoffmannia uniflora Standl., sp. nov.

Branches fruticose, slender, brownish, the branchlets very slender, subterete, bifariously rufous-puberulent, the internodes short; stipules deltoid, acutish, about 1 mm. long, deciduous; leaves opposite, the petioles slender, 3 to 6 mm. long, sparsely puberulent, the blades narrowly oblong-elliptic or lance-elliptic, 4 to 8 cm. long, 1 to 2 cm. wide, attenuate to the base, acuminate or long-acuminate at the apex, membranaceous, deep green above, glabrous, paler beneath, sparsely puberulent along the veins or glabrate, the lateral veins very slender, about 6 on each side, arcuate-divaricate or ascending; flowers mostly solitary, sometimes in 2-flowered cymes, the pedicels slender, 3 to 6 mm. long, glabrate; calyx lobes linear, acute, in fruit 2 to 3 mm. long; fruit oval, 6 to 7 mm. long, 5 to 6 mm. wide, costate, glabrous; seeds minute, brownish, coarsely reticulate.

Type in the U. S. National Herbarium, no. 941382, collected near Cobán, Alta Verapaz, Guatemala, altitude 1,100 meters, February, 1908, by H. von Tuerckheim (no. II. 2107).

Related to *H. mexicana* (Link, Klotzsch & Otto) Hemsl., but in that the calyx lobes are minute and broadly deltoid.

Hoffmannia panamensis Standl., sp. nov.

Shrub or small tree, 2 to 4 meters high, glabrous throughout, the branches slender, subterete, the internodes elongate; leaves opposite, the petioles slender, 1 to 3.5 cm. long, the blades oblong, elliptic-oblong, or lance-oblong, 7 to 15.5 cm. long, 2.5 to 5.5 cm. wide, acute or very obtuse at the base, long-acuminate or cuspidate-acuminate at the apex, membranaceous, bright green above, pale yellowish green beneath, the lateral veins prominent, about 11 on each side; cymes sessile, few or many-flowered, dense, the flowers 4-parted, short-pedicellate or subsessile; calyx 2.5 mm. long, the lobes triangular or lance-triangular, acute, minute at anthesis, sometimes elongate in fruit; corolla yellow, 7 to 8 mm. long, the lobes lance-oblong, acutish, twice as long as the tube or longer; ovary 2-celled.

Type in the U. S. National Herbarium, no. 677443, collected in forests along the Río Ladrillo, above El Boquete, Chiriquí, Panama, altitude 1,200 to 1,300 meters, March, 1911, by H. Pittier (no. 3056).

Hoffmannia calycosa Donn. Smith, of Guatemala, is a near relative, but is distinguished by the long, linear calyx lobes.

***Hoffmannia tonduzii* Standl., sp. nov.**

Shrub, the branchlets slender, subterete, glabrous, the internodes elongate; stipules minute; leaves opposite, the petioles stout, 2 to 6 mm. long, glabrous, the blades oval-elliptic or broadly obovate-elliptic, 6.5 to 12 cm. long, 3.5 to 5.5 cm. wide, acute or cuneate at the base, acuminate or cuspidate-acuminate at the apex, with an obtuse acumen, membranaceous, glabrous, dark green above, paler beneath, the lateral veins slender, about 8 on each side, subarcuate; cymes few-flowered, sessile or subsessile, the pedicels in fruit up to 5 mm. long, some of the flowers usually sessile; calyx glabrous or sparsely puberulent, the tube turbinate, angulate, 2.5 mm. long, the lobes narrowly triangular, 1 to 1.5 mm. long, acute; corolla 6 to 7 mm. long (perhaps longer), glabrous outside, the lobes lance-oblong, acute, twice as long as the tube.

Type in the U. S. National Herbarium, no. 941386, collected in forests of Las Vueltas, Tucurrique, Costa Rica, altitude 635 to 700 meters, May, 1899, by A. Tonduz (no. 13373).

Distinguished from *H. panamensis*, described above, by the few-flowered inflorescences, elongate pedicels, turbinate calyx tube, and proportionately broader leaf blades.

***Hoffmannia orizabensis* Standl., sp. nov.**

Low shrub, the branches slender, decumbent, rufous-villosulous when young; leaves opposite, the petioles slender, 0.5 to 2 cm. long, rufous-villosulous or puberulent, the blades elliptic or elliptic-oblong, 3 to 8 cm. long, 1 to 3 cm. wide, acute at the base, acute or subacuminate at the apex, membranaceous, deep green on the upper surface, rufous-villosulous along the costa, conspicuously white-striolate, paler beneath, rufous-villosulous along the veins, the costa slender, prominent, the lateral veins slender, prominulous, 7 to 9 on each side, ascending, strongly arcuate; inflorescence 4-flowered, the peduncles slender, about 1 cm. long, rufous-villosulous, the pedicels slender, 2 to 3 mm. long; calyx sparsely villosulous, the tube oblong-turbinate, 2.5 mm. long, the lobes narrowly triangular, acute; corolla 12 to 13 mm. long, sparsely villosulous outside, the throat ampliate, the lobes ovate-oval, obtuse or rounded, half as long as the tube; anthers obtuse.

Type in the Gray Herbarium, collected in the region of Orizaba, Veracruz or Puebla, Mexico, in 1855, by Mueller (no. 1359).

Hoffmannia affinis Hemsl., of Costa Rica, known to the writer only from the original description, must be closely related to the present plant, but it is described as having a corolla only 6 to 8 mm. long, with lobes slightly longer than the tube.

***Hoffmannia decurrens* Standl., sp. nov.**

Shrub, the branches grayish, the branchlets stout, subangulate, rufous-villosulous or glabrate, the internodes mostly elongate; stipules deltoid, minute; leaves opposite, the petioles stout, 0.5 to 3 cm. long, villosulous or glabrate, the blades oblong-ob lanceolate or narrowly elliptic, 7.5 to 16.5 cm. long, 1.8 to 4.5 cm. wide, long-attenuate to the base, acute or short-acuminate at the apex, membranaceous, dark green above, glabrous, paler beneath, villosulous along the veins or finally glabrate, the lateral veins slender, arcuate-ascending, 8 to 10 on each side; cymes usually many-flowered, sessile or short-pedunculate,

the branches rufous-villosulous, the flowers subsessile or the pedicels sometimes 5 mm. long, the bracts minute; calyx rufous-villous or villosulous, the tube obovoid, 2.5 to 3 mm. long, the lobes triangular or narrowly triangular, 1 to 1.5 mm. long, obtuse; corolla 8 to 9 mm. long, white, tinged with rose, sparsely villous or villosulous, the lobes oblong, obtuse, slightly shorter than the tube; fruit oval, about 6 mm. long, villosulous; seeds about 1 mm. long, brown, dull, coarsely reticulate.

Type in the U. S. National Herbarium, no. 392077, collected in forests of Santa Rosa Copey, Costa Rica, altitude 1,800 to 2,000 meters, April, 1898, by A. Tonduz (no. 12230). Tonduz's numbers 11671 and 11909, from the same locality, collected in February, 1898, represent the same species.

Hoffmannia cuneatissima Robinson, described from Morelos, Mexico, is a similar plant, but in it the calyx lobes are minute and the lobes of the corolla longer than the corolla tube.

***Hoffmannia confertiflora* Standl., sp. nov.**

Branches slender, obtusely quadrangular, glabrous, the internodes elongate; stipules caducous; leaves opposite, the petioles 5 to 10 mm. long, glabrate, the blades elliptic or oblong-elliptic, 6 to 11.5 cm. long, 2.5 to 4 cm. wide, acuminate or long-attenuate at the base, acuminate at the apex, membranaceous, deep green above, copiously ferrugino-villous, paler beneath, villosulous along the veins, the lateral veins prominent, about 11 on each side, arcuate-divaricate; cymes sessile, few-flowered, dense, the flowers sessile or short-pedicellate, 4-parted; calyx 2 to 2.5 mm. long, glabrous, the lobes minute, broadly deltoid; corolla 9 mm. long, glabrous, the lobes lance-oblong, acute, equaling the tube; anthers 3 mm. long.

Type in the U. S. National Herbarium, no. 888491, collected at San Miguel Uspantán, Quiché, Guatemala, altitude 2,100 meters, April, 1892, by Heyde and Lux (J. D. Smith, no. 3169).

Readily distinguished from related species by the villosulous upper surface of the leaves.

***Hoffmannia angustifolia* Standl., sp. nov.**

Suffrutescent, glabrous throughout, the branches stout, subterete, the internodes short; leaves opposite, the petioles 1 to 2.5 cm. long, the blades very narrowly elliptic, 10.5 to 20 cm. long, 3.5 to 5 cm. wide, long-attenuate at the base, long-attenuate or subacuminate to the obtuse apex, subchartaceous, bright green above, slightly paler beneath, the lateral veins prominent, 12 to 14 on each side, arcuate-ascending at an obtuse angle; cymes sessile, few or many-flowered, dense, shorter than the petioles, the flowers sessile or nearly so, 4-parted; calyx tube 2 mm. long, the lobes lance-oblong, 1 to 1.5 mm. long, obtuse, minutely ciliolate; corolla 12 mm. long, glabrous, the lobes linear-oblong, obtuse, ascending, equaling or slightly shorter than the tube; anthers 3 mm. long.

Type in the U. S. National Herbarium, no. 888492, collected at Acatepeque, Department of Zacatepequez, Guatemala, altitude 1,290 meters, March, 1892, by John Donnell Smith (no. 2747).

Hoffmannia psychotriaefolia (Benth.) Griseb., of Costa Rica, is closely related, but is separated by its minute, deltoid calyx lobes and broad, cuspidate-attenuate leaf blades.

***Hoffmannia chiapensis* Standl., sp. nov.**

Branches stout, obtusely quadrangular, glabrous, the internodes mostly elongate; stipules small deltoid; leaves opposite, the petioles slender, 1.7 to 6 cm. long, glabrous, the blades elliptic or elliptic-oblong, 10 to 19 cm. long, 4 to 7.5 cm. wide, acuminate or attenuate at the base, acuminate at the apex, often falcate-acuminate, membranaceous, bright green above, glabrous, pale beneath, sparsely

villosulous along the costa or glabrate, the lateral veins prominent, about 14 on each side, arcuately subdivaricate; cymes sessile or short-pedunculate, few or many-flowered, about 2 cm. long, the flowers 4-parted, the pedicels slender, 1 to 6 mm. long; calyx tube oblong, glabrous, 2 mm. long, the lobes lance-triangular or oblong, obtuse, 1 to 2.5 mm. long, sparsely puberulent; corolla 10 to 12 mm. long, yellow, glabrous, the lobes narrowly oblong, obtuse, about equaling the tube; anthers 3 mm. long, yellow; fruit oblong, 5 mm. long or larger.

Type in the U. S. National Herbarium, no. 567526, collected on Cerro del Boquerón, Chiapas, Mexico, June, 1914, by C. A. Purpus (no. 7268, in part). Specimens of the same collection in the Gray Herbarium and the herbarium of the New York Botanical Garden also belong here.

Hoffmannia konzattii Robinson and *H. strigillosa* Hemsl. are both close relatives, but have the leaves glabrous or strigillose beneath and of different outline.

A specimen of Purpus's no. 7268 in the herbarium of the Missouri Botanical Garden is the type of *Hoffmannia rotundata*, described above.

NEW RUBIACEAE OF VARIOUS GENERA FROM NORTH AMERICA.

Of the species of this group discussed here the most interesting is the new *Duroia*, for this genus has been known previously only from South America. It is a characteristic example of the numerous genera added to the known flora of North America by recent explorations in Panama and Costa Rica. The writer has already described species of *Cassupa*¹ and *Stachyarrena*² from Panama, two other genera previously believed to be exclusively South American.

Alseis Schott; Spreng. Syst. Veg. 4: Cur. Post. 404. 1827.

A collection made by Dr. G. F. Gaumer at Buena Vista Xbac, Yucatán (no. 1043), is of unusual interest, because it belongs undoubtedly to this genus. The material collected consists of leafless fruiting branches, and so, unfortunately, it is impossible to determine what species is represented. *Alseis* is represented by four known species, three of them natives of Brazil and Venezuela, the other, *A. blackiana* Hemsl., of Colombia and Panama. The Yucatán collection, consequently, represents a large extension of range for the genus. So far as may be judged from the fruit the Yucatán plant may be the same as the Panamanian one. Doctor Gaumer gives the Maya name as "cacaoché."

Hamelia costaricensis Standl., sp. nov.

Branchlets stout, angulate, densely and minutely fulvous-puberulent; stipules small, deltoid; leaves opposite, the petioles slender, 1.2 to 3.5 cm. long, minutely puberulent, the blades oval-ovate or oval-elliptic, 8 to 19 cm. long, 4 to 10.5 cm. wide, rounded and short-decurrent at the base, very acute or subacuminate at the apex, membranaceous, minutely puberulent along the veins, the venation prominent beneath, the lateral veins about nine on each side, subarcuate; inflorescence pedunculate, branched, the branches puberulent, the flowers sessile, secund; calyx densely puberulent, the tube oblong, 3.5 mm. long, the lobes subu-

¹ Contr. U. S. Nat. Herb. 18: 135. 1916.

² Contr. U. S. Nat. Herb. 18: 142. 1916.

late, 1 to 1.5 mm. long; corolla densely fulvous-puberulent in bud, becoming glabrate, the tube 2.2 cm. long, ampliate upward, 6 to 7 mm. wide in the throat, the lobes rounded, 5 mm. long, spreading.

Type in the U. S. National Herbarium, no. 764417, collected near San Mateo, Costa Rica, August, 1890, by P. Biolley (no. 2656).

The material available is scanty but sufficient to show the essential characters of the plant. *H. xorullensis* H. B. K. is perhaps the nearest ally, being distinguished by a larger corolla which is copiously pilose or villosulous outside.

***Hamelia panamensis* Standl., sp. nov.**

Tree, 4.5 meters high, with a trunk 10 cm. in diameter, the bark gray, the branchlets grayish, glabrous; leaves apparently opposite, the petioles about 5 cm. long, the blades oval or broadly ovate, 11 to 19 cm. long, 6 to 12 cm. wide, broadly rounded at the base and short-decurrent, acute or short-acuminate at the apex, membranaceous, glabrous, bright green, the lateral veins about 12 on each side, arcuate-divaricate, the margin plane; inflorescence very ample, much branched, 15 cm. wide or larger, pedunculate, the branches slender, elongate, glabrous, the flowers sessile, the bractlets subulate, very small; calyx glabrous, 2.5 to 3.5 mm. long, the lobes deltoid, acute; corolla about 2.5 cm. long, glabrous, the tube gradually ampliate upward, 4.5 mm. thick in the throat, the lobes ovate, about 6 mm. long, spreading; fruit cylindric, 6 to 7 mm. long, 5-celled; seeds brown, foveolate.

Type in the U. S. National Herbarium, no. 678258, collected above Paca, Panama, April 16, 1908, by R. S. Williams (no. 744). Another specimen of the same collection is in the herbarium of the New York Botanical Garden.

A well-marked species, related to *H. ventricosa* Swartz and *H. cuprea* Griseb., natives of Cuba and Jamaica, but differing from them in the very large leaves and spreading corolla lobes.

***Casasia jacquinioides* (Griseb.) Standl.**

Alibertia jacquinioides Griseb. Cat. Pl. Cub. 123. 1866.

Casasia parvifolia Britton, Bull. Torrey Club 43: 461. 1916.

A very distinct plant, described properly by Britton in the genus *Casasia*. A specimen of the type collection of *Alibertia jacquinioides* in the herbarium of the Missouri Botanical Garden is, however, clearly the same as *Casasia parvifolia*.

***Duroia costaricensis* Standl., sp. nov.**

Branchlets stout, hirsute, densely leafy at the ends; leaves opposite, the petioles stout, 7 mm. long or shorter, densely hirsute, the blades oblong-obovate, 10 to 17.5 cm. long, 3.5 to 6.5 cm. wide, cuneately narrowed to the base, obtuse at the apex and abruptly cuspidate-acuminate, with a narrow falcate acumen, chartaceous, copiously hirsute with slender fulvous hairs, the venation prominent beneath, the lateral veins slender, 7 or 8 on each side, the margin plane; staminate flowers fasciculate-cymose at the ends of the branchlets, short-pedicellate; calyx very densely hirsute with pale brownish hairs, the tube 1.5 mm. long, the limb 4 to 4.5 mm. long, densely whitish-sericeous within, the lobes 6 or 7, distant, linear-subulate, as long as the limb; corolla (in bud) 14 mm. long, densely sericeous outside, the tube stout, glabrous or nearly so within, the 6 lobes lance-oblong, acutish, longer than the tube, finely sericeous within; anthers sessile, 4 mm. long.

Type in the U. S. National Herbarium, no. 938658, collected at Marais de Sierpe, Costa Rica, March, 1892, by H. Pittier (no. 6803).

The genus *Duroia* has not been reported previously from North America. The species are chiefly Brazilian, although some occur in Colombia.

***Phialanthus macrostemon* Standl., sp. nov.**

Branches stout, brownish, roughened by the persistent stipules, the branchlets slightly resinous, minutely papillose-scaberulous; stipule sheath about 2 mm. long; petioles stout, 4 to 5 mm. long, papillose-scaberulous; leaf blades elliptic-oblong or narrowly elliptic, 4 to 5 cm. long, 1.2 to 1.7 cm. wide, broadest at or near the middle, acute or attenuate at the base, narrowed to the rounded apex, rigid-coriaceous, glabrous, the lateral veins obsolete, the costa salient, deep green above, lustrous, brownish beneath, the margin thickened, revolute; inflorescence few-flowered, short-pedunculate, the flowers sessile or nearly so; calyx lobes spatulate, obtuse, at anthesis 1.5 to 2 mm. long, glabrous; corolla, 3.5 mm. long, the lobes ovate-oval, rounded at the apex, less than half as long as the tube; stamens long-exserted, the anthers exceeding the corolla lobes.

Type in the herbarium of the New York Botanical Garden, collected at Pinar de El Purio, Cabonico, Cuba, September 15, 1917, by J. T. Roig (no. 143).

Related to *Phialanthus rigidus* Griseb., a species with narrowly lanceolate leaf blades (3 to 8 mm. wide) and very short petioles. All the species of *Phialanthus* are very closely related, and their validity can not be established until much more material is obtained. The present plant seems to be quite as distinct as the species already described.

***Machaonia coulteri* (Hook. f.) Standl.**

Microsplenium coulteri Hook. f. in Benth. & Hook. Gen. Pl. 2: 4. 1873.

Machaonia fasciculata A. Gray, Proc. Amer. Acad. 19: 77. 1883.

The genus *Microsplenium* Hook. f. was referred originally to the family Caprifoliaceae, but, as has been pointed out by other writers, it differs in no essential character from *Machaonia*. Gray's *Machaonia fasciculata* was founded upon one of the two collections upon which Hooker based the genus *Microsplenium*.

***Chiococca pubescens* Standl., sp. nov.**

Branches slender, green or grayish, short-pilose when young, the internodes shorter than the leaves; stipules 1.5 to 2 mm. long, subulate-cuspidate from a broad base; petioles 2 to 4 mm. long; leaf blades ovate, oblong-ovate, or oval-ovate, 3 to 6 cm. long, 1.2 to 3.2 cm. wide, rounded or obtuse at the base, short-acuminate or subacuminate at the apex, chartaceous, green above, sparsely short-pilose when young, becoming glabrous, the costa and lateral veins prominulous, paler beneath, densely short-pilose or subtomentose when young, often glabrate in age, the costa slender, prominent, the lateral veins prominulous, the margin plane or subrevolute; racemes few-flowered, short-pedunculate, the pedicels 2 to 4 mm. long, short-pilose, the bracts minute; calyx 2.5 mm. long, densely short-pilose, the lobes deltoid, acute; corolla 5 to 6 mm. long, sparsely villosulous or glabrate, the lobes triangular-oblong, obtuse, nearly as long as the tube; anthers semiexserted; fruit (immature) about 3 mm. long, compressed, short-pilose.

Type in the U. S. National Herbarium, no. 840975, collected in the vicinity of San Luis Tultitlan, Puebla, Mexico, July, 1908, by C. A. Purpus (no. 3334). Also collected in the vicinity of Victoria, Tamaulipas, altitude about 320 meters, in 1907, by Edward Palmer (no. 136).

A very distinct plant because of its pubescence, all the others of the genus being glabrous or practically so. The type collection was assigned a new generic name, fortunately unpublished, by Brandegee.

***Guettarda deamii* Standl., sp. nov.**

Tree, 3.5 to 4.5 meters high, the branches blackish, lenticellate, the branchlets stout, densely short-pilose, the internodes short; stipules ovate-oblong,

2.5 to 4 mm. long, obtuse or acutish, appressed-pilose outside, soon deciduous; leaves opposite, the petioles stout, 5 to 9 mm. long, densely short-pilose, the blades mostly oval, sometimes oblong-oval or obovate-oval, 4 to 8.5 cm. long, 2.5 to 4.5 cm. wide, rounded at the base, broadly rounded at the apex, chartaceous, green above, densely short-pilose or pilose-scaberulous, the venation prominulous but more or less embedded, paler beneath, densely velutinous-pilosulous, the costa and lateral veins prominent, the latter 8 to 10 on each side, subarcuate, ascending at an angle of 50° or more, the intermediate veins prominulous, laxly reticulate, the margin recurved; cymes subcapitate, 3 to 5-flowered, the peduncles very stout, 3 to 10 mm. long, densely short-pilose, the flowers sessile, the bractlets subulate, 3 to 4 mm. long, persistent; fruit globose, about 8 mm. in diameter, 3 or 4-celled, minutely tomentulose.

Type in the U. S. National Herbarium, no. 796136, collected on mountain ridges near Gualán, Guatemala, altitude 185 meters, June 15, 1909, by C. C. Deam (no. 6271).

A very distinct plant, of the group of *Guettarda elliptica* Swartz. *Guettarda dichotoma* Mart. & Gal., described from Veracruz, may be a near relative, but it is an imperfectly known species.

***Guettarda filipes* Standl., sp. nov.**

Branches blackish or reddish brown, lenticellate, the branchlets slender, densely pilose, the internodes elongate; stipules triangular-lanceolate, filiform-acuminate, about 5 mm. long, deciduous; leaves opposite, the petioles slender, 3 to 8 mm. long, short-pilose, the blades ovate, elliptic, or oblong-elliptic, 3 to 5.5 cm. long, 1.2 to 2.5 cm. wide, rounded to acutish at the base, short-acuminate at the apex, membranaceous, green above, densely short-pilose, at least when young, the venation plane, paler beneath, densely pilose with short, whitish, mostly spreading hairs, the costa and lateral veins prominulous, the latter about 7 on each side, subarcuate, the intermediate veins mostly obsolete, the margin plane; cymes lax, few-flowered, the peduncles subfiliform, 1.3 to 3.5 cm. long, pilose, the branches short, slender, the flowers partly sessile and partly on slender pedicels 1 to 3 mm. long, the bractlets linear, equaling or much longer than the calyx; calyx appressed-pilose, the limb 1.5 mm. long, shallowly bilobate; corolla minutely sericeous outside, the tube slender, 6 to 7 mm. long, the lobes rounded, 1 to 1.5 mm. long, glabrous within; ovary 2-celled.

Type in the U. S. National Herbarium, no. 302475, collected near Huasemote, Durango, Mexico, August 15, 1897, by J. N. Rose (no. 3498).

Related, although probably not very closely, to *G. deamii*, described above; distinguished by the 2-celled ovary, acuminate leaves, and partly pedicellate flowers.

DESCRIPTIONS OF NEW SPECIES OF SEVERAL FAMILIES, WITH MISCELLANEOUS NOTES.

All the new species described below are Mexican plants. Of greatest interest is the *Coussapoa*, obtained in Oaxaca by Doctor Reko, for not only is the species an unusually distinct one but it adds another genus to the long list of known Mexican trees. Another genus, *Tonduzia*, also may be reported from Mexico as the result of Doctor Reko's explorations. The two new species of *Platanus* described here are noteworthy additions to one of our smallest genera of North American trees.

***Brosimum konzattii* Standl., sp. nov.**

Branches grayish, rimose, glabrous; stipules 8 to 13 mm. long, attenuate, sparsely and minutely puberulent outside; leaves glabrous, the petioles stout, 3 to 8 mm. long, the blades narrowly oblong or lance-oblong, sometimes narrowly elliptic-oblong, 4 to 9.5 cm. long, 1.5 to 3.2 cm. wide, rounded or very obtuse at the base, obtuse or acutish at the apex or obscurely obtuse-acuminate, coriaceous, grayish green above, lustrous, the costa prominent, the lateral veins prominulous, 11 to 15 on each side, subdivaricate, slightly paler beneath, the costa stout, prominent, the lateral veins prominulous, the intermediate veins finely reticulate, impressed, the margin plane; flower heads 4 to 6 mm. in diameter, the peduncles 4 mm. long or shorter, obscurely puberulent; bractlets 0.7 to 1.2 mm. broad, glabrous, minutely ciliolate; fruits oblique, slightly compressed, 1.5 to 1.8 cm. in diameter, dark brown; seed depressed-globose, 1.3 to 1.6 cm. in diameter; radicle obtuse.

Type in the U. S. National Herbarium, no. 763895, collected at Cafetal San Rafael, Distrito de Pochutla, Oaxaca, Mexico, altitude 800 meters, May 14, 1917, by Konzatti, Reko, and Makrinus (no. 3286).

The only other Mexican species of the genus is *Brosimum alicastrum* Swartz. It is distinguished from *B. konzattii* by the much larger, relatively broad, acuminate leaves and much larger flower heads.

***Coussapoa rekoi* Standl., sp. nov.**

Branchlets thick, grayish, rugose, minutely puberulent, sparsely aculeolate; stipules 3.5 to 4.2 cm. long, minutely ferrugino-puberulent, copiously aculeolate with short, stout, divaricate or antrorse prickles; petioles very stout, about 1.5 cm. long, obscurely puberulent or glabrate; leaf blades broadly ovate-oval or rounded-ovate, 11 to 19 cm. long, 7.5 to 13 cm. wide, rounded and somewhat unequal at the base, rounded or very obtuse at the apex and abruptly acuminate-apiculate, coriaceous, grayish green above, sublustrous, minutely puberulent or glabrate, the costa and lateral veins prominent, slightly paler beneath, densely and very minutely grayish-puberulent or tomentulose, the costa and lateral veins very prominent, sparsely armed with short stout prickles, the lateral veins 6 to 9 on each side, straight, the transverse veins prominulous, the margin plane or subrevolute; pistillate and staminate heads solitary, the peduncles stout, 0.6 to 1.4 cm. long, minutely puberulent, the heads globose, 1 to 1.4 cm. in diameter; bracts of the staminate heads broad, cucullate, puberulent, the calyx parted almost to the base, the lobes cucullate-obovate, puberulent; stamens 2; bracts of the pistillate heads concrete, the exposed portion muricate and minutely puberulent.

Type in the U. S. National Herbarium, no. 842612, collected at Cafetal Concordia (Cerro Espino), Oaxaca, Mexico, November 15, 1917, by B. P. Reko (no. 3590).

Distinguished from all other species of the genus by the prickles of the branchlets, stipules, and leaves. The vernacular names are "carnero" and "chirimoya." Doctor Reko states that the fruit is edible and that the leaves are sometimes half a meter long.

***Ficus involuta* (Liebm.) Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 298. 1867.**

Urostigma involutum Liebm. Dansk. Vid. Selsk. Skrivt. V. 2: 320. 1851.

Urostigma bonplandianum Liebm. Dansk. Vid. Selsk. Skrivt. 2: 323. 1851.

Ficus bonplandiana Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 298. 1867.

In a recent paper dealing with the Mexican and Central American species of *Ficus*,¹ the writer listed² this species as *Ficus bonplandiana*, but suggested

¹ Contr. U. S. Nat. Herb. 20: 1-35. 1917.

² Op. cit. 30.

that the name *Urostigma involutum* probably referred to the same plant. Through the kindness of Dr. C. H. Ostenfeld, a leaf of the type of *U. involutum*, in the herbarium at Copenhagen, has now been examined, and this shows conclusively that the two specific names are synonymous. The correct name for the plant, then, is *Ficus involuta* (Liebm.) Miquel.

Struthanthus densiflorus (Benth.) Standl.

Loranthus densiflorus Benth. Pl. Hartw. 62. 1840.

Struthanthus diversifolius (Benth.) Standl.

Loranthus diversifolius Benth. Pl. Hartw. 63. 1840.

Struthanthus grahami (Benth.) Standl.

Loranthus grahami Benth. Pl. Hartw. 62. 1840.

Struthanthus haenkeanus (Presl) Standl.

Spirostylis haenkeanus Presl; Schult. Syst. Veg. 7: 163. 1829.

Loranthus spirostylis DC. Prodr. 4: 315. 1830.

Struthanthus hartwegi (Benth.) Standl.

Loranthus hartwegi Benth. Pl. Hartw. 62. 1840.

Struthanthus inconspicuus (Benth.) Standl.

Loranthus inconspicuus Benth. Bot. Voy. Sulph. 102. 1844.

Struthanthus inornus (Robins. & Greenm.) Standl.

Loranthus inornus Robins. & Greenm. Amer. Journ. Sci. 50: 163. 1895.

Phrygilanthus sonora (S. Wats.) Standl.

Loranthus sonora S. Wats. Proc. Amer. Acad. 24: 73. 1889.

Ximenia pubescens Standl., sp. nov.

Branches slender, grayish, armed with stout straight spines 5 to 8 mm. long, the branchlets densely pilose with short fulvous hairs, the pubescence persistent in age; petioles stout, 3 to 5 mm. long, densely puberulent; leaf blades orbicular or broadly oval, 2.2 to 4 cm. long, 2 to 3.5 cm. wide, rounded at the base, rounded at the apex and often obscurely emarginate, coriaceous, densely puberulent; pedicels and calyx densely puberulent; calyx lobes minute, broadly ovate, obtuse or acutish; petals 4.5 to 5 mm. long, acute or acutish, puberulent outside, densely barbate within from the middle to the base; anthers about 1.5 mm. long.

Type in the U. S. National Herbarium, no. 888478, collected between Mixtepec and Colotepec, Oaxaca, Mexico, altitude 75 to 240 meters, March 6, 1895, by E. W. Nelson (no. 2448).

Two other species of *Ximenia* are known from Mexico, *X. americana* L. and *X. parviflora* Benth., both of which are glabrous plants. *X. pubescens* differs from both in its broad leaves, but the small corolla indicates a relationship with the latter species.

A specimen collected in the foothills of the Sierra Madre, Sinaloa, by J. N. Rose, July 13 to 20, 1897, also has pubescent leaves, but the blades are oblong or elliptic-oblong, and very small. It is accompanied by fruit, but without flowers its position is doubtful. Probably it represents an undescribed species, but it may be only a variant of *X. pubescens*.

Platanus chiapensis Standl., sp. nov.

Tree, 15 meters high, the branchlets grayish brown, with a feltlike brownish tomentum at first but soon glabrate; petioles stout, 2 to 6 cm. long, tomentose at first; leaf blades very broadly ovate or ovate-orbicular, 8.5 to 23.5 cm. long, 5.5 to 19 cm. wide, rounded or subtruncate at the base and usually abruptly short-decurrent, very acute to long-acuminate at the apex, with a few coarse mucronate teeth near or above the middle or sometimes shallowly trilobate,

with entire acute lobes, brownish-tomentose at first on the upper surface but soon glabrate, beneath densely covered with a close, grayish or yellowish tomentum; peduncle and rachis together 24 cm. long, slender, glabrate; heads 3 or 4, 2.5 to 3 cm. in diameter, borne on stout stalks 1 to 2 cm. long; achene 5 to 5.5 mm. long, glabrous below, densely pilose above, about equaled by the basal hairs, the persistent style 3 to 4 mm. long.

Type in the U. S. National Herbarium, no. 470790, collected at Zinacantan, Chiapas, Mexico, May 16, 1904, by E. A. Goldman (no. 993). Immature specimens, apparently referable here, were obtained at Teopisca, Chiapas, by G. N. Collins and C. B. Doyle (no. 128).

Most closely related to *P. lindeniana* Mart. & Gal., but easily distinguished by the stalked pistillate heads.

***Platanus oaxacana* Standl., sp. nov.**

Young branches grayish or dark brown, glabrate; petioles stout, 1 to 3.5 cm. long, tomentose; leaf blades 6.5 to 15 cm. long, 7.5 to 18.5 cm. wide, truncate or subcordate at the base, obscurely or not at all decurrent, usually shallowly trilobate, the lobes long-acuminate, irregularly dentate with coarse acuminate teeth, green and glabrate on the upper surface, covered beneath with a sparse close grayish tomentum; heads 3 or 4, sessile, 3 to 3.8 cm. in diameter, the peduncle stout, 4 to 5 cm. long; achene 6 to 7 mm. long, tomentose at the apex at first but soon glabrate, the persistent style 3 to 4 mm. long.

Type in the U. S. National Herbarium, no. 888488, collected at San Miguel Alborrados, Oaxaca, Mexico, altitude 1,950 meters, July 2, 1894, by E. W. Nelson (no. 540).

The present plant is evidently related to *P. lindeniana* Mart. & Gal., of which it may be only a form, but in that species the leaves are narrower, rounded, and decurrent at the base, with a loose whitish tomentum, and the long, narrow lobes are commonly entire.

***Prunus prionophylla* Standl., sp. nov.**

Plant glabrous throughout, the branches dark brown or blackish, roughened with numerous lenticels; petioles stout, about 1 cm. long; leaf blades lance-oblong or narrowly elliptic-oblong, 9 to 11 cm. long, 3 to 3.5 cm. wide, rounded or obtuse at the base, acute at the apex, the venation impressed, pale beneath, the costa very stout and salient, the lateral veins plane or prominulous, the margin coarsely serrate almost to the apex, the lower surface usually with 2 glands at the base adjacent to the costa; racemes axillary, subsessile, solitary, naked, 4 to 5 cm. long, densely many-flowered, the pedicels very stout, 3 to 4 mm. long; calyx tube 3 mm. long, glabrous within, soon deciduous, the lobes oblong-oval; petals rounded, about 3 mm. long and broad, glabrous, white; ovary ovoid, tapering to the style; stigma about 1 mm. broad.

Type in the U. S. National Herbarium, no. 470171, collected along brooks on Ixtaccihuatl, Mexico, altitude 2,100 to 2,400 meters, in 1903, by C. A. Purpus (no. 249).

A species of the subgenus *Laurocerasus*, but not closely related to any known from Mexico. The coarse teeth of the leaves suggest the very different *Prunus ilicifolia* (Nutt.) Walp., of California and Baja California.

***Caesalpinia acapulcensis* Standl., sp. nov.**

Unarmed shrub or small tree; branches terete, brown, with large pale lenticels, puberulent when young and furnished with short-stipitate glands; petioles 2.5 to 3 cm. long, sometimes with scattered stipitate glands; pinnae 2 or 3 pairs; leaflets 1 or 2 pairs, opposite, short-petiolulate, obliquely ovate, oval-oblong, or oval, 2 to 4 cm. long, 1.5 to 2.7 cm. wide, very oblique at the base,

rounded at the apex, chartaceous, glabrous, green above, pale beneath, the venation prominent or prominulous; racemes 5 to 14 cm. long, paniculate, few or many-flowered, the pedicels 5 to 11 mm. long, minutely pilose and densely covered with stipitate glands; calyx densely glandular, the tube about 4 mm. broad, the lobes oval, entire; petals 8 to 10 mm. long, yellow, with numerous sessile or stipitate glands outside on the lower part; stamens longer than the petals, the filaments white-villous below; fruit 6.5 to 7.5 cm. long, about 1.7 cm. wide, subsessile, minutely pilose, eglandular, elastically bivalvate.

Type in the U. S. National Herbarium, no. 266490, collected in the vicinity of Acapulco, Guerrero, Mexico, in 1894 or 1895, by Edward Palmer (no. 505).

Related to *C. mexicana* A. Gray as closely as to any of the described Mexican species. In that, however, the inflorescence is without glands and the leaflets are smaller and more numerous.

***Caesalpinia caladenia* Standl., sp. nov.**

Unarmed shrub or small tree, the branches terete, striate, brown or reddish brown, with numerous pale lenticels, short-pilose and glandular when young; petioles 1.5 to 3 cm. long, short-pilose or glabrate and sometimes glandular; pinnae 2 to 4 pairs; leaflets 3 or 4 (rarely 2) pairs, short-petiolulate, oval, elliptic-oblong, or oblong-obovate, 1 to 2.6 cm. long, 0.5 to 1.7 cm. wide, rounded to subacute at the base and often oblique, rounded at the apex, glabrous, slightly paler beneath, chartaceous, with prominulous venation; racemes many-flowered, 6.5 to 17 cm. long, the pedicels 6 to 16 mm. long, jointed below the calyx, densely short-pilose and furnished with numerous reddish stipitate glands; calyx tube 5 to 7 mm. broad, pilose and stipitate-glandular, the lobes 6.5 to 8.5 mm. long, oblong, rounded at the apex, velvety-pilose, glandular on the margins; petals 10 to 12 mm. long, glandular outside on the lower portion; stamens equaling or slightly exceeding the petals, the filaments densely white-villous except near the apex; fruit 4.5 to 6.5 cm. long, 1.2 to 1.6 cm. wide, subsessile, straight, densely velutinous and covered with sessile or stipitate glands, elastically bivalvate.

Type in the U. S. National Herbarium, no. 635473, collected on hills about 5 miles below Minas Nuevas, Sonora, Mexico, March 12, 1910, by J. N. Rose, P. C. Standley, and P. G. Russell (no. 12660).

Here, also, may be referred the following collections:

COLIMA: Manzanillo, *Palmer* 1397. Colima, 1891, *Palmer* F.

The Colima specimens have somewhat larger leaflets than the type. *Caesalpinia caladenia* is related to *C. acapulcensis*, described above, but differs in the glandular fruit, larger flowers, and smaller, narrower, more numerous leaflets.

***Caesalpinia sclerocarpa* Standl., sp. nov.**

Unarmed tree, the branches slender, brown or grayish, with numerous pale lenticels, glabrous; leaves glabrous, usually odd-pinnate, the petioles 1 to 1.6 cm. long, the pinnae 4 or 5, the leaflets 3 or 4 pairs, opposite, short-petiolulate, elliptic to oblong, 10 to 18 mm. long, 5 to 9 mm. wide, rounded or obtuse at the base, usually slightly oblique, broadly rounded at the apex, chartaceous, the costa prominent beneath but the other venation inconspicuous; racemes axillary or paniculate, 4 to 7 cm. long, few or many-flowered, dense, the rachis angulate, fulvous-puberulent, the pedicels stout, 2 to 3 mm. long; calyx densely fulvous-puberulent, the tube 3 to 4 mm. broad, the lobes very unequal, entire, the outer one larger than the others; petals about 7 mm. long; stamens equaling the petals, the filaments villous below; fruit 3.5 to 8 cm. long, 1.4 to 1.8 cm. wide, rounded at both ends, short-rostrate at the apex, blackish, glabrous, borne on a stout stipe 5 mm. long, indehiscent, the valves very thick (about 3 mm.) and hard.

Type in the U. S. National Herbarium, no. 229315, collected between San Gerónimo and La Venta, Oaxaca, Mexico, altitude 60 meters, July 13, 1895, by E. W. Nelson (no. 2784).

The following additional collections belong here:

SINALOA: Between Rosario and Acaponeta, *Rose* 1870. Guadalupe, *Rose*, *Standley & Russell* 14748. Near Colomas, *Rose* 3241.

JALISCO: Jayamita, *Jones* 164.

Closely related, apparently, to *C. glabrata* H. B. K., a plant of Peru and Colombia, with glabrous calyx and smaller leaflets. *C. vesicaria* L., known in Mexico only from Yucatán, is a similar plant, but it has very large, coriaceous leaflets of different shape.

***Cassia chiapensis* Standl., sp. nov.**

Erect shrub, the branches stout, terete, very densely pilose with grayish or fulvous hairs; stipules lance-linear, 11 to 15 mm. long, attenuate, deciduous, pilose outside; petioles 1.5 to 3.5 cm. long, the rachis 4 to 7 cm. long, densely pilose, a slender clavate gland usually present between each pair of leaflets; leaflets 3 to 6 pairs, oval, oblong-oval, or ovate-oval, 2 to 4 cm. long, 1.2 to 2.5 cm. long, petiolulate, rounded and subequal at the base, rounded at the apex, chartaceous, green on the upper surface, glabrous, the venation rather conspicuous, densely pilose beneath with slender whitish subappressed hairs; flowers racemose, the racemes many-flowered, dense, 4.5 to 10 cm. long, borne on a stout pilose peduncle 4 to 8 cm. long, the pedicels 6 to 13 mm. long, the bracts short, lance-linear, caducous; outer sepals oval, 3.5 mm. long, sparsely short-pilose, green, the inner ones rounded-obovate, 5 mm. long, yellowish, ciliate; petals 5 to 7 mm. long, spatulate-obovate, short-clawed, glabrous, pale yellow, conspicuously veined; stamens 10, 3 of them abortive, 3 of them with stout anthers 3.5 mm. long, the other 4 with anthers 2.5 mm. long, the anthers erostrate, opening by apical pores; ovary densely pilose; fruit about 5 cm. long and 7 mm. wide, very acute and stipitate at the base, obtuse or acutish and short-rostrate at the apex, glabrous at maturity, the valves thin, flat, the seeds transverse-oblique.

Type in the U. S. National Herbarium, no. 470740, collected at Teopisca, Chiapas, Mexico, May 7, 1904, by E. A. Goldman (no. 939). Also collected between San Cristóbal and Teopisca, Chiapas, altitude 2,000 to 2,550 meters, December 4, 1895, by E. W. Nelson (no. 3481a).

This plant belongs to Bentham's section *Chamaesenna*, and apparently to the series *Pachycarpae*, but it is not closely related to any of the species referred there by that author. The small flowers are the most prominent character.

***Cassia tonduzii* Standl., sp. nov.**

Tree or large shrub, the branches slender, striate-angulate, fulvous-puberulent; stipules subulate, deciduous; petioles 1.5 to 2 cm. long, the rachis 5 to 10 cm. long, sparsely puberulent, usually with a long slender clavate gland between each pair of leaflets; leaflets 4 to 6 pairs, short-petiolulate, elliptic to narrowly lance-elliptic, 2 to 9 cm. long, 1 to 2.8 cm. wide, rounded to subacute at the base, acuminate or abruptly acuminate at the apex, rarely only acute, membranaceous, green on the upper surface, sublustrous, glabrous or very minutely puberulent, the venation mostly impressed, scarcely paler beneath, thinly strigillose with slender, grayish or yellowish hairs, the costa and lateral nerves slender but very prominent, the margin plane or revolute; flowers in 2 or few-flowered axillary racemes borne on slender peduncles, very numerous, the pedicels long and slender, puberulent; sepals orbicular, the outer

ones 5 mm. long, sparsely puberulent, the inner ones 8 to 10 mm. long, glabrous; petals very unequal, 2 of them about 2.5 cm. long and 2 cm. wide, the others lanceolate or ovate, 1 to 1.5 cm. long and 2 to 4 mm. wide, slender-clawed, all more or less puberulent; stamens 10, 3 of them abortive, the 3 largest ones with curved anthers nearly 1 cm. long terminating in a slender tube 5 to 6 mm. long, the other 4 with erostrate anthers 4 mm. long; ovary densely appressed-pilose with fulvous hairs; fruit (immature) 16 to 18 cm. long, 5 to 6 mm. wide, glabrate, long-stipitate, rounded and rostrate at the apex, the valves flat, thin.

Type in the U. S. National Herbarium, no. 471718, collected along the Río Tiliri, Costa Rica, November 23, 1892, by A. Tonduz (no. 7213).

The following additional specimens belong here:

COSTA RICA: Río Tiliri, December, 1890, *Tonduz* 3197. Alajuelita, alt. 1,100 meters, December, 1889, *Tonduz* 1484.

CHIAPAS: Between Tuxtla and Cristóbal, alt. 690 to 1,650 meters, 1895, *Nelson* 3127.

This species belongs to Bentham's section *Chamaescenna*, series *Rostratae*. It seems to be related to *Cassia robiniaefolia* Benth., but in that the leaflets are more numerous and obtuse or acutish, with inconspicuous venation. One of the Costa Rican collections was determined by Micheli as *C. laevigata* Willd., a species not closely related to the present one.

***Indigofera sphinctosperma* Standl., sp. nov.**

Shrub, the branches very slender, densely white-strigose; stipules very short, subulate; leaves petiolate, the rachis very slender, the leaflets usually 11 to 15, oval or rounded-oval, the largest 13 mm. long and 8 mm. wide, rounded or very obtuse at the base, broadly rounded at the apex and mucronulate, densely or sparsely gray-strigose on both surfaces, conspicuously petiolulate; racemes slender, 5 to 15 cm. long, the flowers short-pedicellate, at first dense but distant in anthesis, the bracts filiform-subulate; calyx densely strigose, the lobes triangular, equaling or slightly longer than the tube; standard petal about 3.5 mm. long, densely strigose; fruit 3 to 4 mm. long, tetragonous, white-strigillose, sessile, subtruncate at each end, slightly constricted; seed 1.2 to 2.5 mm. long, cylindric, subtruncate at each end, olivaceous, usually with 2 shallow transverse constrictions.

Type in the U. S. National Herbarium, no. 840446, collected in the Barranca de Santa María, Zacuapan, Veracruz, Mexico, November, 1906, by C. A. Purpus (no. 2332).

The following collections also belong here:

VERACRUZ: Baños de Carrizal, *Purpus* 6077. Barranca de Santa María, *Purpus* 3641.

Several other species of *Indigofera* found in Mexico have short, one or few-seeded pods, but in all of them the seeds are shorter and of different shape, and the fruit is either globose or ovoid, with an acute or rounded apex.

***Phyllocarpus septentrionalis* Donn. Smith, Bot. Gaz. 55: 433. 1913.**

This recently described plant is a most interesting one, because of the fact that the only other known representative of the genus is a native of Brazil. The type of *P. septentrionalis* was collected near Gualán, Guatemala. Recently there have been received at the National Herbarium complete specimens collected one mile above El Progreso, Guatemala, at an altitude of 510 meters, by F. W. Popenoe (no. 759). Mr. Popenoe's notes regarding this collection are as follows: "Large tree, about 15 meters high, in sandy soil along the banks of streams. Flowers light scarlet. The tree blooms when nearly devoid of leaves, and is a mass of flowers." The vernacular name is given as "flor de mico."

***Cracca brandegei* Standl., sp. nov.**

Plants slender, erect or ascending, herbaceous or suffrutescent, much branched from the base, the stems angulate, densely hirtellous with short spreading whitish hairs; stipules subulate, 3 mm. long; petioles 1 to 2 cm. long, the rachis 2 to 5 cm. long, hirtellous; leaflets 9 to 19, distant, linear or oblong-linear, 0.6 to 4.5 cm. long, 1.5 to 6 mm. wide, acute at the base, acute or obtuse at the apex, thin, copiously pilose on the upper surface with very short whitish subappressed hairs, thinly sericeous or short-pilose beneath, the lateral nerves numerous, parallel, ascending at a very acute angle; racemes leaf-opposed, 10 to 23 cm. long (including the peduncle), slender, the flowers remote, the bracts short, subulate; pedicels slender, 2 to 4 mm. long, hirtellous; calyx 2.5 to 3.5 mm. long, hirtellous, the lobes triangular, attenuate, as long as the tube; corolla purple, the standard 7 to 8 mm. long, finely sericeous outside; fruit 3 to 4 cm. long, 2.5 to 3 mm. wide, very flat, minutely pilose with spreading or subappressed hairs; seeds 2.5 to 3 mm. long, mottled with black and olivaceous brown, with a minute strophiole.

Type in the U. S. National Herbarium, no. 572116, collected at Altata, Sinaloa, Mexico, September 2, 1904, by T. S. Brandege. Also collected in the vicinity of Durango in 1896 by Edward Palmer (no. 375).

Closely related to *C. purpurea* L. (*Tephrosia tenella* A. Gray), but in that the pubescence is closely appressed. *Cracca vicioides* (Schlecht.) Kuntze also is a near relative, but that is a bright green, nearly glabrous plant, with brown pubescence on the stems, and with leaflets glabrous on the upper surface.

***Cracca tepicana* Standl., sp. nov.**

Plants apparently decumbent, herbaceous or suffrutescent, the stems slender, flexuous, hispidulous when young, glabrate in age; stipules small, subulate; leaves sessile or petiolate, the rachis 3.5 to 10 cm. long; leaflets 5 to 11, oblong, elliptic-oblong, or oval-oblong, 2 to 4.8 cm. long, 1 to 2 cm. wide, short-petiolulate, rounded at the base, rounded or very obtuse at the apex, chartaceous, green on the upper surface, strigillose or glabrate, the venation prominulous and reticulate, thinly strigose beneath, the venation prominent, the margin hispid-ciliate; racemes 10 to 22 cm. long (including the long peduncle), the flowers in distant or approximate fascicles, the slender pedicels 4 to 8 mm. long, strigose, the bracts filiform-subulate, 8 mm. long or shorter; calyx 5 mm. long, strigillose, the lobes triangular-acuminate, about as long as the tube; standard petal 11 to 13 mm. long, and nearly as wide, brownish-sericeous outside; ovary densely sericeous.

Type in the U. S. National Herbarium, no. 305316, collected at Tepic, Mexico, in 1892, by Edward Palmer.

A very distinct plant, related as closely to *C. langlassei* (Michell) Rose, as to any of the Mexican species. The latter is distinguished by its long, copious pubescence and acute leaflets.

***Andira galeottiana* Standl., sp. nov.**

Branches terete, reddish brown or grayish, rimose, the young branchlets stout, angulate, fulvous or ferruginous-tomentose; petioles stout, 4.5 to 6 cm. long, the rachis 5 to 14.5 cm. long, brown-tomentose; leaflets 5 to 13, all opposite or the lower ones alternate, the petiolules very stout, about 6 mm. long, the blades oblong or oval-oblong, rarely obovate-oblong, 3 to 13 cm. long, 2.8 to 5.5 cm. wide, rounded or subtruncate at the base, rounded at the apex and apiculate, subcoriaceous, green on the upper surface, tomentulose when young, becoming glabrate, the venation impressed, beneath densely tomentose or sub-

sericeous with brown lustrous hairs, the margin plane or revolute; racemes densely flowered, pedunculate, 6 to 8.5 cm. long, forming a panicle 20 to 30 cm. long, the branches ferruginous-tomentose, the flowers solitary or fasciculate, short-pedicellate; calyx 8 mm. long, densely tomentose, the lobes deltoid, obtuse or acutish, about 2 mm. long; petals glabrous, long-clawed; standard 17 mm. long, the blade suborbicular, 11 mm. wide, deeply retuse at the apex, subtruncate at the base, the claw 5 to 6 mm. long; blades of the wings oblong, 9 mm. long, 3 mm. wide, rounded at the apex, produced at the base into a rounded auricle, the claw 6 mm. long; keel petals similar to the wings in size and form; stamens diadelphous, the filaments 10 to 14 mm. long; ovary long-stipitate, glabrous, 1 or 2-ovulate.

Type in the U. S. National Herbarium, no. 888479, collected at Catemaco, Veracruz, Mexico, altitude 300 meters, April 26, 1894, by E. W. Nelson (no. 424). Also collected at Lalana (Chinantla), Puebla, July, 1844, by H. Galeotti (no. 3464).

The only other species of *Andira* found in Mexico is *A. jamaicensis* (W. Wright) Urban, a widely distributed plant with glabrous, acute or acuminate leaflets, much smaller flowers, and pubescent ovary.

Galeotti gives the vernacular name as "macayo."

***Picramnia pistaciaefolia* Blake & Standl., sp. nov.**

Branches very slender, flexuous, brownish gray, puberulent when young; leaves 8 to 18 cm. long, the rachis slender, puberulent; leaflets 19 to 23, short-petiolulate, the upper ones opposite, the lower ones smaller and alternate, the lowest pair borne at or near the base of the rachis, the blades ovate-rhombic or the lowest rhombic-oval, 1 to 3.5 cm. long, 0.6 to 1.2 cm. wide, very oblique at the base and obtuse to acuminate, subabruptly obtuse-acuminate at the apex, thin, minutely puberulent when young, glabrate in age; panicles slender, 15 to 20 cm. long, the staminate ones spiciform, the pistillate racemiform, the rachis puberulent; sepals 3, about 1 mm. long, ovate or ovate-oval, obtuse, puberulent outside; petals 3, ligulate, slightly longer than the sepals; stamens 3, twice as long as the petals; fruit (immature) obovoid, about 1 cm. long and 6 mm. in diameter.

Type in the U. S. National Herbarium, no. 842534, collected at Cafetal San Rafael (Cerro Espino), Oaxaca, Mexico, altitude 800 meters, October 28, 1917, by B. P. Reko (no. 3452). The type material consists of a fruiting branch. Specimens in flower were obtained on Cerro de Huatulco, Oaxaca, altitude 900 meters, August 28, 1917, by Doctor Reko (no. 3360).

In the key to the species of *Picramnia* in the North American Flora¹ this plant would run at once to *P. antidesma* Swartz, a species widely different from the present one in the size, form, and texture of the leaflets, and in the size of the flowers. *Picramnia pistaciaefolia* seems to be different also from any of the Mexican species described by Tulasne, which are only mentioned as doubtful in the North American Flora.

Doctor Reko states that the vernacular names are "ramón" and "lentisco."

***Rhus barclayi* (Hemsl.) Standl.**

Rhus terebinthifolia barclayi Hemsl. Biol. Centr. Amer. Bot. 1: 219. 1880.

This is distinguished sufficiently from *R. terebinthifolia* Schlecht. by the long petiolules of the lateral leaflets. The pubescence on the lower surface of the leaflets, too, is much less dense, and consists of long, straight, stiff, rather slender hairs. In *R. terebinthifolia* the lateral leaflets are nearly sessile, and

¹ 25: 235. 1911.

densely velvety-pilose or almost tomentose beneath. The following specimens belong here:

TEPIC: Tepic, 1892, *Palmer* 1907. Between Colomos and Arroyo Juan Sánchez, 1897, *Nelson* 4166.

The type was collected at Acapulco.

***Rhus jaliscana* Standl., sp. nov.**

Shrub, 3 to 4.5 meters high, the branchlets reddish brown, rough-lenticellate, puberulent; leaves pinnate, 9 to 15-foliolate, the petioles slender, 1.5 to 2.5 cm. long, puberulent, the pairs of leaflets 6 to 14 mm. apart, the petiolules 1 to 3 mm. long, slender, the blades elliptic or elliptic-oblong, sometimes ovate, 1.4 to 2.6 cm. long, 0.6 to 1.5 cm. wide, rounded to acutish at the base and usually unequal, commonly obtuse at the apex but sometimes acute or subacuminate, mucronulate, chartaceous, entire, green above, dull, sparsely short-pilose with subappressed hairs or glabrate, the venation more or less impressed, only slightly paler beneath, very sparsely pilose with minute, mostly appressed hairs or subbarbate in the axils of the veins, the lateral veins 4 to 6 on each side, the margin plane or subrevolute; panicles usually much longer than the leaves, the branches very slender, spiciform, remotely flowered, the flowers sessile; bracts rounded-ovate, obtuse, scarious; sepals rounded-ovate, obtuse, glabrous; petals obtuse, about half longer than the sepals; fruit 5 mm. long, 6 to 7 mm. wide, compressed, sparsely setose-pilose.

Type in the U. S. National Herbarium, no. 19926, collected in moist places in the barranca near Guadalajara, Jalisco, Mexico, November 3, 1888, by C. G. Pringle (no. 1774).

ADDITIONAL SPECIMENS EXAMINED:

JALISCO: Between Bolaños and Guadalajara, 1897, *Rose* 3093. Barranca near Guadalajara, 1907, *Safford* 1458a; in 1902, *Pringle* 9712.

Pringle's collections were distributed as *Rhus terebinthifolia* Schlecht., a species with larger, less numerous, subsessile or short-petiolulate leaflets, these usually more acute and more densely pubescent. *R. barclayi* is closely related to *R. jaliscana*, but differs in its large, less numerous, acuminate leaflets.

***Bernoullia flammea* Oliver in Hook. Icon. Pl. 12: 62. pl. 1169, 1170. 1873.**

This remarkable tree, of the family Bombacaceae, was based by Oliver upon specimens and a drawing obtained by Dr. G. Bernoulli in the "Costa Grande of Guatemala, from about 500 to 2,000 ft."¹ So far as the writer knows, the species has been known heretofore only from the original collection. Recently, however, Dr. Blas P. Reko forwarded to the National Herbarium specimens, accompanied by a water-color sketch, which he had obtained at the Cafetal Nueva Esperanza, Oaxaca, Mexico, at an altitude of about 800 meters. Doctor Reko's rediscovery of this little known plant is of unusual interest, since it indicates a noteworthy extension of range for the species. Moreover, this new material shows that the diagnosis of the genus must be corrected in one important respect. The plant was described originally as having digitately trifoliolate leaves, but Doctor Reko states, and the specimens show, that the number of leaflets, though variable, is usually five or six.

Doctor Reko's notes give the following additional information about the plant: "The tree grows in a very limited area on the Cerro Espino, at an altitude of about 800 meters, and reaches a height of 30 to 40 meters. In appearance it reminds one of the ceiba tree, which it resembles also in the soft, spongy

¹ In Engler and Prantl's *Natürlichen Pflanzenfamilien* (3⁶: 65. fig. 34. 1895) Schumann gives the range of the plant as Costa Rica, but presumably this is due to a slip of the pen.

texture of its wood, whence it has received its popular name, 'palo de calabaza.' The deciduous leaves are alternate. The flowers, which appear in the dry season, before the new leaves, are of a vermilion color in all their parts, likewise the branches of the terminal inflorescence. The pollen is smooth on its surface. The fruit resembles in shape that of the genus *Cheirostemon*, although much larger (20 cm. long). It is a 5-valved woody capsule with smooth interior, with grooves and numerous dents for the reception of the ascending seeds."

***Marcgravia guatemalensis* Standl., sp. nov.**

Branches dark brown, glabrous, minutely papillose; petioles very stout, about 2 mm. long; leaf blades narrowly lance-oblong, 9 to 14.5 cm. long, 2 to 4 cm. wide, rounded or very obtuse at the base, somewhat oblique, long-acuminate at the apex, chartaceous, glabrous, minutely papillose, green above, the costa impressed, the lateral veins mostly obsolete, brownish beneath, the costa stout, salient, the lateral veins very slender, usually prominulous, about 13 on each side; racemes short-pedunculate, umbelliform, about 16-flowered, the pedicels about 2.5 cm. long, stout, divaricate, puberulent, the flower inserted obliquely, the rachis prolonged about 8 mm. above the fertile flowers; sepals 1 to 1.5 mm. long, much broader than long, very broadly rounded at the apex; corolla ovoid, 8 mm. long, obtuse, glabrous; stamens about 12; nectaries about 4, tubular-cucullate, straight, clavate above, puberulent, the stipe 1 to 1.2 cm. long, the hood 2 to 2.3 cm. long, 3.5 mm. thick above, the orifice about 3 mm. broad.

Type in the U. S. National Herbarium, no. 408015, collected near the Finca Sepacuité, Alta Verapaz, Guatemala, March 28, 1902, by O. F. Cook and R. F. Griggs (no. 230). Additional material of the same collection, consisting of a sterile branch, is mounted on sheet no. 408014.

This plant is most closely related to *M. eichleriana* Wittmack, of Brazil, but is distinguished by the subsessile leaves and narrow nectaries.

***Tonduzia parvifolia* Pittier, Contr. U. S. Nat. Herb. 12: 103. 1908.**

Heretofore this species has been known only from Costa Rica. Specimens collected at Cafetal Montecristo, Oaxaca, by Dr. B. P. Reko (no. 3382) seem to belong here rather than to *T. stenophylla* (Donn. Smith) Pittier, a Guatemalan species. Doctor Reko gives the vernacular name as "chamizillo."

THE GENUS HOMALIUM IN AMERICA.

By S. F. BLAKE.

INTRODUCTION.

The genus *Homalium*, based on the single species *H. racemosum*, from Martinique, was established by Jacquin¹ in 1760, and in 1763 a more extended description with a figure of the flower was given in his *Selectarum Stirpium Americanarum Historia*.² In 1775 Aublet³ described the new genus *Racoubea* from French Guiana, based on a single species, *R. guianensis*, and with it the genus *Napimoga*,⁴ which has since been considered a more or less doubtful synonym of *Homalium*. Jussieu,⁵ in his *Genera*, referred *Racoubea* to *Homalium* as a synonym, a treatment which has been followed by all subsequent authors, and placed both *Homalium* and *Napimoga* in his group "Genera Rosaceis affinia." Robert Brown⁶ in 1818 made the genus *Homalium* the type of a new order, Homalinae, a classification retained by various authors down to 1857. In Bentham and Hooker's *Genera Plantarum* the genus was placed in the Samydaceae, and in the *Natürlichen Pflanzenfamilien* of Engler and Prantl in the tribe Homalieae of the family Flacourtiaceae.

Only two revisionary treatments of the American species of the genus have been published. Bentham,⁷ revising the genus in 1860, recognized five American species, one from Mexico, one from the West Indies, and three from northern South America, two of which were described as new from Spruce's collections. In 1871 Endlicher⁸ recognized five species from Brazil and adjacent regions, one being here first published. *Homalium cuneifolium* Willd., likewise described for the first time in this connection, is accredited by the *Index Kewensis* to Brazil, but the habitat is said by Endlicher to be unknown, and from the characters given it is clear that the plant belongs to the Old World group of species. Since Bentham's and Endlicher's treatments only three species have been described from America, one each from Oaxaca, Honduras, and Jamaica. In the study of the material accumulated within the last twenty years at the National Museum, the Gray Herbarium, and the herbarium of the

¹ Enum Pl. Carib. 5.

² 170. pl. 183, f. 72.

³ Pl. Guian. 1: 589. pl. 236.

⁴ Op. cit. 592. pl. 237.

⁵ Gen. Pl. 343. 1789.

⁶ Narr. Exp. Congo App. 438.

⁷ Journ. Linn. Soc. Bot. 4: 31-38.

⁸ In Mart. Fl. Bras. 13¹: 505-508. pl. 101.

New York Botanical Garden a number of new species have been distinguished, so that it seems desirable in connection with their description to present a summary of the species now known from America.

All the American species of the genus are very closely related and belong to the section *Racoubea* of the subgenus *Myriantheia*, as the genus is arranged by Warburg in the *Pflanzenfamilien*. The characters of most significance for the separation of the species are found in the sessile or pedicellate flowers, the number of stamens in the fascicles, the separate or united style bases, the pubescence of the leaves, and the shape of the perianth segments.

Reference has already been made to the doubtful association of Aublet's genus *Napimoga* with *Homalium*. Bentham in 1860 was of the opinion that it "can scarcely be a congener, not having the characteristic glands; the analyses given, rude as they are, are not to be depended on for correctness, and afford no evidence of the plant belonging even to the same natural order." In Bentham and Hooker's *Genera* and in later general works, however, *Napimoga* is referred without comment to *Homalium*. It seems to the writer, in view of the important differences indicated by Aublet's description and figures, that Bentham's earlier view is the correct one, and that the genus *Napimoga* should again be placed in the list of genera of uncertain position.

In addition to the material in the National Herbarium, to which have recently been added the specimens of this genus in the herbarium of Captain John Donnell Smith, I have been able through the kindness of Dr. N. L. Britton and Dr. B. L. Robinson to study the material in the herbarium of the New York Botanical Garden and the Gray Herbarium. The location of the specimens cited has been indicated in parenthesis.¹

¹ G=Gray Herbarium; N=U. S. National Herbarium; Y=Herbarium of the New York Botanical Garden.

SYSTEMATIC TREATMENT.

KEY TO SPECIES.

Flowers sessile or subsessile (pedicels 1 mm. long or less).

Leaf blades densely griseous-puberulous beneath; styles distinct; stamens shorter than the petals 4. *H. puberulum*.

Leaf blades glabrous beneath or merely sparsely pubescent along costa and sometimes along veins or in their axils; styles united at base into a column; stamens equaling or exceeding the petals.

Calyx segments 0.8 to 1.2 mm. long; petals 1.8 to 2.4 mm. long, 1.3 to 1.8 mm. wide 1. *H. densiflorum*.

Calyx segments 1.2 to 2.7 mm. long; petals 2.5 to 3.4 mm. long, 1.5 to 2.5 mm. wide.

Leaves 6.5 to 13.3 cm. long, incurved-puberulous on costa beneath; ovary griseous-villous 2. *H. guianense*.

Leaves 14.5 to 17.5 cm. long, spreading-pilose on costa beneath; ovary sparsely pilose 3. *H. nicaraguense*.

Flowers distinctly pediceled (pedicels 1 to 7 mm. long).

Leaf blades more or less densely pilosulous over whole surface beneath.

Calyx tube rounded at base; stamens in fascicles of 4 to 7, their filaments pilose to middle or higher 5. *H. mollicellum*.

Calyx tube contracted into a pediform base; stamens in fascicles of 3, their filaments glabrous 12. *H. trichocladum*.

Leaf blades glabrous beneath or merely barbellate in the axils of the veins, rarely sparsely pubescent along costa and nerves.

Styles united into a short column at base.

Ovary glabrous or with a very few long hairs 7. *H. leiogynum*.

Ovary densely villous.

Stamens in fascicles of 4 to 8; calyx segments elliptic-ovate or ovate, 1.5 to 2 mm. wide 6. *H. pleiandrum*.

Stamens in fascicles of 3 to 5; calyx segments lanceolate to ovate, 0.7 to 1.8 mm. wide.

Younger branchlets glabrous or obscurely puberulous; leaf blades glabrous above; petioles glabrous, 2 to 7 mm. long 8. *H. hemisystylum*.

Younger branchlets griseous-puberulous and sparsely spreading-pilose; leaf blades puberulous along midrib above; petioles puberulous and pilose, 8 to 12 mm. long 13. *H. pedicellatum*.

Styles distinct to base.

Stamens in fascicles of 5 to 7, pilose to middle 17. *H. trichostemon*.

Stamens in fascicles of 2 to 4, glabrous or pilose below.

Calyx segments 4 to 5 mm. long; petals 5.5 to 7 mm. long.

Calyx segments narrowly lanceolate or subulate-lanceolate, 1 to 1.3 mm. wide; leaf blades glabrous above 18. *H. stenosepalum*.

Calyx segments ovate or elliptic, 1.8 to 2.5 mm. wide; leaf blades densely incurved-puberulous along costa above 19. *H. eurypetalum*.

Calyx segments 1.5 to 3.6 mm. long; petals 2.5 to 5 mm. long.

Filaments pilose to middle. Calyx segments 0.6 to 0.7 mm. wide.

16. *H. columbianum*.

Filaments glabrous or sparsely pilose at base.

Calyx segments 0.5 to 0.8 mm. wide; leaf blades 5.5 to 8.7 cm. wide.

15. *H. hondurensense*.

Calyx segments 1 to 1.8 mm. wide, rarely narrower; leaf blades 2.4 to 6 cm. wide.

Branchlets puberulous and spreading-pilose; leaf blades puberulous and pilose along midrib above.....14. *H. eleutherostylum*.

Branchlets glabrous; leaf blades glabrous above or sometimes sparsely incurved-puberulous along midrib.

Leaf blades subentire or obscurely repand-crenate; fruiting calyx tube depressed-turbinate, the pediform base short.

10. *H. integrifolium*.

Leaf blades distinctly crenate-serrate; fruiting calyx tube turbinate, or sometimes depressed-turbinate, the pediform base distinct, sometimes as long as the body.

Peduncles incurved-puberulous; leaf blades incurved-puberulous or strigose along midrib beneath, not barbellate in the axils of the veins11. *H. pittieri*.

Peduncles glabrous; leaf blades glabrous along midrib beneath, sometimes barbellate in the axils.

Leaf blades glabrous beneath; inflorescence paniculate; calyx segments ovate-lanceolate.....9. *H. racemosum*.

Leaf blades barbellate in the axils of the veins beneath; inflorescence simply racemose; calyx segments usually lanceolate9a. *H. racemosum barbellatum*.

DESCRIPTION OF SPECIES.

1. *Homalium densiflorum* Spruce; Benth. Journ. Linn. Soc. Bot. 4: 36. 1860.

Older branches gray, glabrous; younger branches fuscous gray, lenticellate, sparsely and finely incurved-puberulous or glabrous; leaf blades 7 to 10 cm. long, 3.5 to 4 cm. wide, oval or ovate-oval to elliptic-obovate, obtuse or short-pointed and acute at tip, rounded to acutely cuneate at base, crenate-dentate with 9 to 15 pairs of obtuse teeth, subcoriaceous, in age sparsely incurved-puberulous along costa above or glabrous, shining, beneath glabrous or barbellate in the axils, somewhat reticulate-veined, with 6 to 8 pairs of lateral veins; petioles 6 to 7 mm. long, sparsely incurved-puberulous or pilose, at least above; peduncles axillary and terminal, solitary or in pairs, 1 to 2.3 cm. long, densely griseous-puberulous with very short spreading hairs or subglabrous; inflorescences spicate or racemo-paniculate, slender, 3.5 to 5.5 cm. long, their lower branches 1 to 1.5 cm. long and many-flowered, or suppressed, the upper flowers solitary and crowded; pedicels 0.5 mm. long or less; fruiting calyx tube turbinate, rounded at base, griseous-puberulous; calyx segments 5 or 6, triangular to linear-lanceolate, obtusish or acute, 0.8 to 1.2 mm. long, 0.6 to 0.7 mm. wide; fruiting corolla 7 to 8 mm. wide; petals ovate, obtusish, griseous-puberulous, 1.8 to 2.4 mm. long, 1.3 to 1.8 mm. wide; stamens in fascicles of 3 or 4, the filaments glabrous, equaling or slightly exceeding the petals; glands oblate, tomentose-pilosulous; styles 3, glabrous or pilose at base, united at base into a glabrous or pilose column nearly or quite as long as their free portions; ovary conic or depressed-conic, griseous-villous.

TYPE LOCALITY: Vicinity of Santarem, Pará, Brazil.

SPECIMENS EXAMINED:

BRAZIL: Vicinity of Santarem, Pará, January, 1850, *Spruce* (type collection; G).

Without definite locality, *Burchell* 7787 (G).

This species is readily distinguishable by its small sessile flowers and its very small calyx segments.

2. *Homalium guianense* (Aubl.) Warb. in Engl. & Prantl, Pflanzenfam. 3^{ae}: 36. 1893.

Racoubea guianensis Aubl. Pl. Guian. 1: 590. pl. 236. 1775.

Homalium spicatum Lam. Encycl. 1: 32. 1783.

Homalium racoubea Swartz, Prodr. Veg. Ind. Occ. 86. 1788.

Older branches glabrous or sparsely puberulous, the bark grayish brown; young branchlets incurved-puberulous and sparsely pilose; leaf blades 6.5 to 13.3 cm. long, 3.5 to 6.8 cm. wide, obovate-oval to elliptic or oval, obtuse or short-pointed but the apex blunt, cuneate to rounded at base, repand-crenate with 11 to 20 blunt teeth, pergamentaceous in age, above very sparsely puberulous, more densely so along the midrib, glabrate in age, beneath along costa and sometimes along the 5 to 11 pairs of lateral veins sparsely incurved-puberulous or pubescent, in age nearly or quite glabrous, sometimes barbellate in the axils of the veins; petioles 3 to 7 mm. long, incurved-puberulous or incurved-pubescent; peduncles axillary and terminal, incurved-puberulous, 2.8 to 5 cm. long; inflorescences spikelike and simple, or sometimes conic-paniculate, loosely flowered, 8 to 17 cm. long; lower branches of the inflorescence (peduncles of the second order) 0.5 to 4 cm. long; ultimate pedicels 1 mm. long or less; fruiting calyx tube depressed-turbinate, 5 or 6-sulcate, not contracted into a pediform base, griseous-puberulous; calyx segments triangular-lanceolate or narrowly lanceolate, acutish or acute, 1.2 to 2.3 mm. long, 0.6 to 1.2 mm. wide; corolla 9 to 12 mm. wide; petals deltoid-ovate, griseous-puberulous, in flower 2.5 mm. long, 2 to 2.5 mm. wide, in fruit 3 to 3.4 mm. long, 2.5 mm. wide; glands transversely oval-oblong or lunate-oblong, tomentose-puberulous; stamens in fascicles of 2 to 4, exceeding the petals, their filaments glabrous; styles 3 or "4", united at the base into a short column, glabrous or pilose at base; ovary depressed-conic, griseous-villous.

TYPE LOCALITY: "Sur l'habitation de Madame Gourde, dans le Comté de Gêne," French Guiana.

ILLUSTRATIONS: Aubl. Pl. Guian. pl. 236; Lam. Tabl. Encycl. pl. 483, f. 1; Mart. Fl. Bras. 13¹: pl. 101, f. II.

SPECIMENS EXAMINED:

BRITISH GUIANA: *Schomburgk* I. 225 (N). Upper Demerara River, September, 1887, *Jenman* 4022 (N).

SURINAM: Without definite locality, *ex herb.* *Miquel* (G).

BRAZIL: *Burchell* 9685 (G, N).

This species is reported by Benthams and Eichler from the three Guianas and from the provinces Amazonas, Pará, and Goyaz, Brazil. According to H. L. Gerth van Wijk's Dictionary of Plant Names, the species bears the following vernacular names: "bita hoedoe" (Surinam), "acomas à épis," "acomas en épis," "mavavé," "mavévé," "racoube de la Guiane," and "ahriger akomasbaum." *Jenman's* label bears the name "conageddyballi."

Aublet says of his *Racoubea guianensis*: "On emploie la racine de cet arbrisseau en tisane pour guérir les gonorrhées. * * * Les Créoles appellent cet arbrisseau *mavévé*, nom qu'ils donnent à plusieurs plantes dont ils font usage pour la cure de différentes maladies."

8. *Homalium nicaraguense* Blake, sp. nov.

Tree of medium size; branchlets fuscous gray, lenticellate, finely incurved-puberulous and sparsely pilose; leaf blades 14.5 to 17.5 cm. long, 5.3 to 6.5 cm. wide, elliptic-oblong or obovate-oblong, short-acuminate, at base rounded or cuneate-rounded, crenate-serrate, thin-pergamentaceous, feather-veined (lateral veins 7 to 9 pairs) and somewhat prominulous-reticulate, above sparsely incurved-puberulous and sometimes very sparsely pilose on costa, otherwise glabrous, beneath equally green, spreading-pilose on costa, especially below the middle, otherwise glabrous, not barbellate in the axils of the veins; petioles incurved-puberulous and sparsely pilose, 4 to 6 mm. long; inflorescences axillary, with one or two branches at base, these 1 to 4 cm. long, otherwise simply spicate-racemose; peduncle (1 to 4.5 cm. long) and axis (16 to 22 cm. long) griseous-puberulous with curved hairs; pedicels 0.5 mm. long or less; fruiting calyx tube turbinate, obtuse, not contracted into a pediform base, griseous-puberulous, sulcate; calyx segments 6, lanceo-

late, acute, griseous-puberulous, 1.8 to 2.7 mm. long, 1 mm. wide; petals ovate or rhombic-ovate, obtuse, griseous-puberulous, 2.5 to 2.8 mm. long, 1.5 to 2 mm. wide; stamens in fascicles of 3 or 4, equaling the petals, the filaments glabrous; ovary short-conic, sparsely pilose; styles 3, long, united into a glabrous column nearly as long as ovary.

Type in the U. S. National Herbarium, no. 1,010,053, collected at "B. J. Camp," vicinity of San Juan del Norte (Greytown), Nicaragua, February 18, 1896, by C. L. Smith (no. 3).

This species is closely related to *H. guianense* (Aubl.) Warb., but may be distinguished by its much larger leaves which are spreading-pilose on the costa beneath, its sparsely pilose ovary, longer and glabrous style column, and longer styles.

4. *Homalium puberulum* Klotzsch; Eichl. in Mart. Fl. Bras. 13¹: 507. 1871.

Older branches grayish fuscous, at length glabrate; branchlets of the year densely griseous-puberulous and short-pilose; leaf blades 5.3 to 10 cm. long, 3.2 to 5 cm. wide, elliptic, oblong-elliptic, or obovate-elliptic, obtuse or short-pointed with blunt tip, cuneate to rounded at base, crenate with 10 to 22 blunt gland-tipped teeth on each side, pergamentaceous, above dull green, rather sparsely puberulous, densely so along midrib, with incurved hairs, beneath densely griseous-puberulous with incurved hairs, barbellate in the axils of the veins; petioles densely griseous-puberulous and short-villous, 7 to 9 mm. long; peduncles short-villous and griseous-puberulous, axillary and subterminal, 1.8 to 2.5 cm. long; racemes simple, spikelike, loosely flowered, the rachis 4 to 5.5 cm. long; lower pedicels 0.8 mm. long, the upper obsolete; corolla 11 mm. wide in fruit; fruiting calyx tube depressed-turbinate, without pediform base, 7 or 8-sulcate, puberulous like both sides of the limb; calyx segments 7 or 8, ovate or lance-ovate, acute, 2 to 2.5 mm. long, 0.7 to 1.2 mm. wide; petals 7 or 8, ovate or broadly ovate, 3.2 to 4 mm. long, 2 to 2.5 mm. wide; stamens in fascicles of 3 or 4, the filaments slightly hairy at base, shorter than the petals; glands oblate, puberulous; styles 3, distinct, glabrous; ovary depressed-conic, densely puberulous and short-villous.

TYPE LOCALITY: Banks of the River Sururu, British Guiana. Type collected by Richard Schomburgk (no. 1463).

SPECIMEN EXAMINED:

BRAZIL: Without locality, *Burchell* 8203 (N).

From *H. mollicellum*, which it most resembles, this species is distinguished by its subsessile flowers, smaller fascicles of stamens, and more depressed calyx tube.

Although the type number of this species has not been available for examination, the specimens of *Burchell* 8203 in the National Herbarium agree so well with the description as to leave no doubt of their identity. The type number was referred by Bentham in his revision to *H. racoubea* (*H. guianense*), although that was described by him as possessing glabrous leaves. It is possible that the two species were distributed by Schomburgk under his number 1463.

5. *Homalium mollicellum* Blake, sp. nov.

Older branchlets glabrate, lenticellate, grayish-barked; branchlets of the year brownish gray, puberulous with short spreading hairs, some longer spreading hairs intermixed; leaf blades 5.5 to 9.5 cm. long, 3.2 to 3.8 cm. wide, elliptic or oblong-elliptic, short-pointed with blunt or emarginulate tip, rounded at base, shallowly repand-crenate with 11 to 16 blunt teeth on each side, chartaceous-pergamentaceous, with 9 to 12 pairs of lateral veins, above pale green, finely puberulous, glabrescent, beneath densely and softly cinerascens-pilosulous with spreading hairs; petioles tomentose-puberulous and villous, 5 to 8 mm. long; peduncles axillary and subterminal, 2.5 to 3.8 cm. long; racemes nearly simple, puberulous and short-villous, rather loosely flowered, the rachis 7.3 to 9.5 cm. long; lower branches of the raceme (peduncles of the second order) 2 or 3-flowered, 2 to 8 mm. long; pedicels 0.8 to 2 mm. long; fruiting calyx tube turbinate, rounded at base, 6 or 7-sulcate, densely and canescently tomentose-puberulous like both faces of the limb; calyx segments 6 or 7, ovate,

obtusish, 2.8 to 3.5 mm. long, 1.3 mm. wide; corolla in fruit 12 mm. wide; petals 6 or 7, ovate, obtusish, tomentose-puberulous and somewhat villous, 4 to 4.3 mm. long, 2 to 2.5 mm. wide; glands oval, tomentulose; stamens 4 to 7 in a fascicle, their filaments pilose to middle or higher; styles 3, distinct to base, hairy below; ovary conic from a broad base, densely spreading-villous.

Type in the U. S. National Herbarium, no. 399,375, collected at Coquillo, Guerrero, Mexico, May 3, 1903, by E. W. Nelson (no. 7034).

Easily distinguished from any other Mexican species by the softly pilosulous under leaf surface.

6. *Homalium pleiandrum* Blake, sp. nov.

Older branches grayish, the younger fuscous, glabrous; leaf blades 4.5 to 9 cm. long, 3.2 to 4.7 cm. wide, oval or ovate-oval, normally short-pointed and acute or acuminate at tip, rarely rounded or obtuse, rounded at base, coarsely repand-crenate with blunt teeth, subcoriaceous, above glabrous and shining, beneath barbellate in the axils of the veins, otherwise glabrous, reticulate-venulose, with 6 to 8 pairs of lateral veins; petioles glabrous, 4 to 5 mm. long; racemes axillary and subterminal, simple, loosely or somewhat densely flowered, on glabrous peduncles 1.5 to 2.5 cm. long, the rachis griseous-puberulous, 2.5 to 4.5 cm. long; pedicels 1 to 2 mm. long; calyx tube in flower slenderly turbinate, gradually narrowed into a pediform base, densely griseous-puberulous; calyx segments 6 or 7, elliptic-ovate or ovate, sparsely sordid-puberulous outside, densely so within, 3.2 to 3.8 mm. long, 1.5 to 2 mm. wide; corolla 8.5 to 12 mm. wide; petals 6 or 7, densely sordid-tomentellous on both sides, ovate or triangular-ovate, acutish, 4.5 to 4.8 mm. long, 2.5 to 2.8 mm. wide; stamens in fascicles of 4 to 8, the filaments glabrous, about equaling the petals; styles 2 to 4, united into a short column, glabrous or sparsely hairy at base; ovary depressed-conic, densely sordid-villous.

Type in the U. S. National Herbarium, no. 426,086, collected in pastures near Rio Piedras, Porto Rico, March 30, 1899, by Mr. and Mrs. A. A. Heller (no. 957).

OTHER SPECIMENS EXAMINED:

PORTO RICO: Rio Piedras, 1912, *Cowgill* 281, 326 (Y). Red clay slopes, Mayaguez, April, 1913, *Britton & Hess* 2818 (N). Monte Alegriillo, June 20, 1913, *Stevens* 2341 (Y). Rio Icaco and vicinity, Sierra de Naguabo, 1914, *Shafer* 3492 (Y). Woods near Ceiba, Naguabo, April 25, 1885, *Sintenis* 1161 (G, N). In woods, Fajardo, April 16, 1885, *Sintenis* 957 (N). Forests, Sierra de Luquillo, May, 1883, *Eggers* 1238 (N). Mt. Jiminez, Sierra de Luquillo, July, 1885, *Sintenis* 1374 (N). Without definite locality, July 17, 1913, *Stevens* 8400 (Y). Duplicates of the type, *Heller* 957 (Y).

Homalium pleiandrum and the two following species, *H. leiogynum* and *H. hemisystylum*, all of which are confined to Porto Rico, and with the exception of *H. racemosum barbellatum* are the only species known from that island, are certainly very closely allied and may require union when more material has been accumulated, although as now represented in herbaria they seem distinct. As a group they differ from *H. racemosum* and its subspecies *barbellatum* in having their styles united into a short column at base. *H. leiogynum*, at present known only from a single collection, is unique, at least among the American species of the genus, in its ovary, which is absolutely glabrous or sometimes bears about half a dozen long hairs. It is not impossible, however, that it represents merely an extreme variation of *H. pleiandrum*. *H. pleiandrum* and *H. hemisystylum*, which agree in the possession of a densely villous ovary, differ from one another in number of stamens and in the shape of the calyx segments.

Urban¹ records *H. racemosum* from Porto Rico and gives its vernacular names as "coracolillo," "cerezo," and "tostado." The specimens cited, however, belong to *H. pleiandrum*, *H. leiogynum*, and *H. hemisystylum*.

¹ Symb. Antill. 4: 417. 1910.

7. *Homalium leiogynum* Blake, sp. nov.

Older branches clothed with a gray bark, the younger fuscous brown, glabrous; leaf blades 6 to 9.5 cm. long, 3 to 4 cm. wide, elliptic to oval, abruptly or gradually pointed, acute or acuminate at tip, rarely obtuse, at base rounded or rounded-cuneate, pergamentaceous, undulate-crenate, above glabrous, beneath sparsely barbellate in the axils or glabrous, reticulate-veined on both sides, with 6 or 7 pairs of lateral veins; petioles glabrous, 2 to 5 mm. long; peduncles glabrous, axillary and subterminal, 1.7 to 3.5 cm. long; racemes simple, the rachis sparsely puberulous, 1.2 to 4.5 cm. long, rather loosely flowered; pedicels 1.2 to 2.5 mm. long, incurved-puberulous; flowering calyx slenderly turbinate, narrowed into a pediform base, 5 to 7-sulcate, sparsely puberulous with subappressed hairs; calyx segments 5 to 7, lanceolate or ovate-lanceolate, narrowed to an obtuse tip, outside sparsely, within more densely puberulous with subappressed hairs and ciliolate, 3.2 to 4 mm. long, 1 to 1.2 mm. wide; corolla in flower 9.5 to 11.5 mm. wide; petals elliptic-ovate or lance-ovate, acutish or obtuse, puberulous and ciliolate, 4.4 to 4.6 mm. long, 1.3 to 2.2 mm. wide; stamens in fascicles of 4 to 6, the filaments glabrous, shorter than the petals; glands oblate, griseous-puberulous; styles 3 or 4, glabrous, united at base into a glabrous column; ovary conic, glabrous or with a very few long hairs.

Type in the U. S. National Herbarium, no. 462,116, collected in dry woods at Fajardo, Porto Rico, April 7, 1899, by Mr. and Mrs. A. A. Heller (no. 992). A specimen of the same collection is in the herbarium of the New York Botanical Garden.

Homalium leiogynum is readily distinguished by its glabrous ovary and 4 to 6- androus fascicles of stamens.

8. *Homalium hemisystylum* Blake, sp. nov.

Older branches grayish, glabrous, the younger fuscous or fuscous gray, glabrous or very finely puberulent; leaf blades 4.5 to 8.8 cm. long, 2.3 to 6 cm. wide, oval or elliptic, short-pointed, rounded at base, coarsely crenate, subcoriaceous, above glabrous, beneath barbellate in the axils or sometimes entirely glabrous; petioles glabrous, 2 to 7 mm. long; peduncles axillary and subterminal, sparsely incurved-puberulous or sometimes glabrate, 1.5 to 2.7 cm. long; racemes simple, loosely flowered, the axis sparsely incurved-puberulous, 1.5 to 4.5 cm. long; pedicels 1 to 2 mm. long; fruiting calyx tube slenderly turbinate, contracted gradually into a pediform base, finely incurved-puberulous; calyx segments 5 to 7, ovate or lance-ovate to lanceolate, narrowed to the acutish or obtuse tip, sparsely puberulous outside, densely griseous-puberulous within, 3.5 to 4 mm. long, 0.7 to 1.8 mm. wide; corolla 11 to 13 mm. wide; petals ovate or oblong-ovate, obtusish, rather densely griseous-puberulous on both sides, 4.5 to 5.5 mm. long, 1.8 to 2.5 mm. wide; stamens in fascicles of 3 or 4, or rarely 5, the filaments glabrous, shorter than the petals; styles 3 or 4, glabrous, united at base into a glabrous or sparsely pilose column about one-third their length; ovary conic, sordid-villous, usually glabrous or nearly so toward the margin of the broad base.

Type in the U. S. National Herbarium, no. 430,335, collected in the Sierra de Luquillo, Porto Rico, June 15, 1902, by Percy Wilson (no. 259).

OTHER SPECIMENS EXAMINED:

PORTO RICO: Wooded hill, Colonia San Miguel, near Fajardo, March, 1913, *Britton & Shafer* 1620 (N). Mountain forest, altitude 900 meters, Mt. Alegrillo, April, 1913, *Britton, Stevens & Hess* 2589 (N). Duplicates of the type, *Wilson* 259 (Y).

Most nearly related to *H. leiogynum*, but separable by the smaller fascicles of stamens and by the villous ovary.

9. *Homalium racemosum* Jacq. Enum. Pl. Carib. 24. 1760.

Older branches gray-barked, the younger fuscous, glabrous, marked with whitish lenticels; leaf blades 8 to 12.5 cm. long, 3.7 to 6 cm. wide, elliptic or ovate-elliptic, acuminate to a blunt tip, cuneate to rounded at base, pergamentaceous, crenate or

crenate-serrate with 10 to 22 pairs of blunt teeth, bearing 6 to 10 pairs of lateral veins with prominulous-reticulate secondary and tertiary veinlets, glabrous on both sides; petioles glabrous, 6 to 11 mm. long; peduncles axillary and terminal, glabrous, 2.6 to 4.2 cm. long; panicles conic or pyramidal, loosely flowered, 6.5 to 9 cm. long, the lowest branches 1.8 to 6.3 cm. long, the upper much shorter, puberulous with dull incurved or ascending hairs; pedicels 1 to 4 mm. long; fruiting calyx tube turbinate, contracted into a distinct but short pediform base, slightly sulcate, rather densely puberulous with dull incurved hairs; calyx segments 5 to 7, lanceolate to ovate-lanceolate, narrowed to an acutish tip, puberulous outside, more densely so inside, 3 to 3.5 mm. long, 1.2 to 1.6 mm. wide; corolla 8 to 12 mm. wide; petals 5 to 7, ovate, obtusish, griseous-puberulous on both sides, 3.5 to 5 mm. long, 2 to 2.8 mm. wide; stamens in fascicles of 3 or 4, the filaments glabrous or pilose at the base, shorter than the petals; styles 3, distinct, pilose at base; ovary conic, densely dull-pilose.

TYPE LOCALITY: Pastures, mouth of the River Capot, Martinique.

ILLUSTRATIONS: Jacq. Stirp. Amer. pl. 183, f. 72; Lam. Tabl. Encycl. pl. 483, f. 2; Lodd. Bot. Cab. pl. 261; Bot. Reg. pl. 519; Diet. Sci. Nat. pl. 244.

SPECIMENS EXAMINED:

ANTIGUA: *Duss* 42 (Y).

GUADELOUPE: *Duss* 2427 (Y). Abundant at altitudes up to 600 meters, flowering in May and June, *Duss* 2998 (N).

MARTINIQUE: *Sieber* 143 (N). Fort Vaillant, December, 1867, *Hahn* (G). In 1879, *Duss* 1806 (N).

A single flower of *Hahn's* plant from Martinique has a cluster of 7 filaments before one of the petals, but other fascicles in the same flower and on other flowers of the same specimen have the normal number of 3 or 4.

H. L. Gerth van Wijk, in his Dictionary of Plant Names, gives the following local names for this species: "acoma," "acomas á grappes," "acouma" (Martinique), "bois d'acouma," "bois incorruptible," "mavévé," and "traubiger akomasbaum."

9a. *Homalium racemosum barbellatum* Blake, subsp. nov.

?*Homalium obtusatum* Turcz. Bull. Soc. Nat. Moscou 31¹: 465. 1858.

Similar to the species; leaf blades barbellate in the axils of the veins beneath, sometimes smaller, thicker, and obtuse, 4.5 to 12.5 cm. long, 2.5 to 6 cm. wide; racemes simple or essentially so, the peduncles 4.2 cm. long or less, the rachis 1.5 to 8 cm. long; fruiting calyx often with conspicuous pediform base as long as the body; sepals usually lanceolate and acuminate, rarely ovate, 2.8 to 3.5 mm. long, 0.7 to 1.4 mm. wide; stamens, styles, and ovary as in the typical form.

Type in the U. S. National Herbarium, no. 656806, collected in Hope River Valley, Jamaica, September 27, 1907, by William Harris (no. 9981).

ILLUSTRATION: Swartz, Fl. Ind. Occ. 3: pl. 17 (as *H. racemosum*).

OTHER SPECIMENS EXAMINED:

CUBA: Near Monte Verde, January to July, 1859, *Wright* 1106 (G).

JAMAICA: *March* (G). Old England, altitude 1160 meters, 1896, *Harris* 6465 (Y).

Lacovia, 1907, *Britton* 1481 (Y). Hope River below August Town, 1907, *Britton* 1701 (Y). Duplicate of the type, *Harris* 9981 (Y).

SANTO DOMINGO: Barahona, 1900, *Fuertes* 35 (Y).

PORTO RICO: Maricao, 1913, *Hioram* (Y). Dry hills, Yauco, 1901, *Underwood & Griggs* 660 (N). Loma Icaco, Sierra de Naguabo, 1914, *Shafer* 3444 (Y).

10. *Homalium integrifolium* Britton, Bull. Torrey Club 37: 354. 1910.

Tree, about 15 meters high; older branchlets dull gray, the younger fuscous, dotted with whitish lenticels, glabrous; leaf blades 7 to 14.5 cm. long, 2.5 to 4.8 cm. wide, elliptic, oblong-elliptic, or ovate-elliptic, acuminate or acute, with obtuse tip, rounded and inequilateral at base, pergamentaceous, obscurely repand-crenate or crenate-serrate to subentire, glabrous on both sides except for occasional tufts of hairs in the

axils of the veins beneath, reticulate-venose, the lateral veins 6 to 9 pairs; petioles glabrous, 5 to 11 mm. long; racemes axillary, solitary, simple, loosely flowered, rather densely puberulous, the rachis 4.5 to 7 cm. long; peduncles very sparsely puberulous, 1.3 to 2.5 cm. long; pedicels 1 to 3.5 mm. long, incurved-puberulous; fruiting calyx tube strongly depressed-turbinate, contracted into a short pediform base, very obscurely sulcate, griseous-puberulous; calyx segments 6, lanceolate or ovate-lanceolate, narrowed to an obtusish tip, griseous-puberulous on both sides and ciliate, 1.5 to 3 mm. long, 0.6 to 1.3 mm. wide; corolla 7.5 to 11 mm. wide; petals 6, ovate or oval-ovate, narrowed to an obtusish tip, griseous-puberulous and somewhat ciliate, 2.5 to 3.8 mm. long, 1.5 to 2.7 mm. wide; stamens in fascicles of 3, the filaments glabrous, shorter than the petals; styles 3, distinct to base, pilose below; ovary depressed-conic, griseous-villous.

TYPE LOCALITY: Woodlands, eastern slopes of southern end of John Crow Mountains, Jamaica.

SPECIMENS EXAMINED:

JAMAICA: Woodlands, eastern slopes of southern end of John Crow Mountains, March 10, 1909, *Harris & Britton* 10741 (type collection; N, Y). Westphalia Estate, St. Andrews, 1885, *Hart* 636 (N).

The local name of this species is given on the label of the type collection as "white cogwood."

11. *Homalium pittieri* Blake, sp. nov.

Tree, 15 to 20 meters high; older branches grayish, lenticellate, the younger fuscous, glabrous; leaf blades 5.5 to 11.3 cm. long, 3 to 6 cm. wide, oval to ovate-oval, short-pointed, with obtuse or acutish tip, rounded or cuneate-rounded at base, crenate or undulate with 10 to 16 pairs of rounded depressed teeth, subcoriaceous, above deep green, somewhat shining, sparsely incurved-puberulous (chiefly along midrib) or glabrous, beneath duller or paler green, in youth sparsely strigillose and along midrib strigose, at maturity glabrous or sparsely strigillose on surface, along midrib sparsely incurved-puberulous or strigose, not barbellate in the axils, with 5 to 7 pairs of primary veins and prominulous-reticulate secondaries; petioles sparsely incurved-puberulous or strigillose, 6 to 14 mm. long; peduncles axillary and terminal, incurved-puberulous, 1.5 to 2.5 cm. long; inflorescences conic-cylindric, paniculate at base, simply racemose above, the rachis griseous-puberulous, 2.8 to 4.5 cm. long, the lowest branches few-flowered, about 5 mm. long; pedicels 1.5 to 2.5 mm. long; flowers whitish; calyx tube turbinate or in fruit depressed-turbinate, narrowed into a distinct pediform base, griseous-puberulous and obscurely sulcate; calyx segments 6 or 7, oblong to elliptic-oblong, obtuse, griseous-puberulous, 2 to 3 mm. long, 0.7 to 1.8 mm. wide; corolla 11 to 13 mm. wide; petals 6 or 7, oval or oval-ovate, obtuse, griseous-puberulous, 3.8 to 4.2 mm. long, 1.5 to 2.7 mm. wide; stamens in fascicles of 3, much shorter than petals, the filaments glabrous; glands oval, griseous-puberulous; ovary conic, griseous-villous; styles 3, distinct, glabrous or sparsely pubescent at base.

Type in the U. S. National Herbarium, no. 892,575, collected in light woods in the Lower Catuche wood above Caracas, Venezuela, altitude 1,000 to 1,200 meters, September, 1917, by H. Pittier (no. 7390).

OTHER SPECIMENS EXAMINED:

VENEZUELA: Parque de los Bárbaros, Los Teques, State of Miranda, October 19, 1917, *Pittier* 7515 (N).

Homalium pittieri is most closely related to *H. racemosum* Jacq., of the Lesser Antilles. From that species it differs in its incurved-puberulous peduncles, its leaves incurved-puberulous or strigose along the midrib beneath, its oblong or elliptic-oblong calyx segments, its depressed-turbinate fruiting calyx tube, and its less paniculate inflorescence. Eichler's record of *H. pedicellatum* from Caracas probably refers to this species.

12. *Homalium trichocladum* Blake, sp. nov.

Tree; older branchlets grayish, glabrous, the younger fuscous, densely incurved-puberulous and spreading-pilose with griseous hairs; leaf blades 4.2 to 9.5 cm. long, 2.8 to 4.7 cm. wide, elliptic, oblong-elliptic, or oval, obtuse or short-pointed, with obtuse tip, rarely rounded or subtruncate, at base cuneate, rounded, or subtruncate, crenate-serrate, with 12 to 19 pairs of blunt teeth, somewhat shining above, paler beneath, membranaceous-chartaceous, above puberulous along costa and slightly so along the lateral veins (these 7 or 8 pairs), on surface very sparsely pubescent or glabrous, beneath along veins spreading-pilosulous, barbellate in the axils, between the veins rather sparsely but softly incurved or ascending-pilosulous; petioles densely puberulous and pilose, 3 to 7 mm. long; peduncles axillary and subterminal, solitary, densely incurved-puberulous and spreading-pilose, 2.5 cm. long; racemes simple, loosely few-flowered, the rachis 1.5 to 3.5 cm. long; pedicels 1.7 to 2.5 mm. long; calyx tube turbinate in flower, contracted into a pediform base, griseous-puberulous; calyx segments 5, ovate or lance-ovate, narrowed to an obtusish tip, griseous-puberulous on both sides, 3.4 to 4 mm. long, 1.2 to 1.4 mm. wide; corolla white, 9 to 12 mm. wide in flower; petals 5, ovate or ovate-lanceolate, narrowed to an obtusish tip, griseous-puberulous on both sides, 4.3 to 5.3 mm. long, 1.5 to 2.3 mm. wide; stamens in fascicles of 3, the filaments glabrous, much shorter than the petals; styles 3, distinct to base, hairy below the middle; ovary short-conic, densely griseous-villous.

Type in the Gray Herbarium, collected in the Province of Barahona, Santo Domingo, June, 1911, by Padre Miguel Fuertes (no. 1098).

A sheet of sterile specimens in the herbarium of the New York Botanical Garden, collected by Britton and Wilson (no. 15443), in a river thicket, San Pedro and vicinity, Isle of Pines, agrees perfectly with the type in characters of foliage and pubescence, but, in the absence of flowers or fruit, it does not seem advisable to refer it definitely to this species.

13. *Homalium pedicellatum* Spruce; Benth. Journ. Linn. Soc. Bot. 4: 36. 1860.

Older branchlets fuscous brown, glabrate, the younger fuscous, griseous-puberulous and sparsely hispid-pilose with spreading hairs; leaf blades 7 to 11.8 cm. long, 2.5 to 4.7 cm. wide, oblong-elliptic or lance-elliptic, short-pointed, with an obtuse tip, rounded or sometimes cuneate at base, pergamentaceous, crenate-dentate with 10 to 18 pairs of obtuse teeth, very shiny above, incurved-puberulous along costa and sometimes very sparsely on surface, beneath dull, barbellate in the axils, sparsely pilose along midrib, with 5 to 9 pairs of lateral veins; petioles rather sparsely pilose and puberulous, 8 to 12 mm. long; racemes axillary, loosely flowered, simple, griseous-puberulous with incurved hairs and sparsely pilose, the peduncle 3 to 3.5 cm. long, the rachis 9 to 15 cm. long; pedicels 1 to 6 mm. long; fruiting calyx tube turbinate, contracted into an obscure and very short pediform base, griseous-puberulous and sparsely pilose; calyx segments lanceolate, narrowed to an acutish or obtusish tip, griseous-puberulous outside and ciliate, nearly glabrous within below middle, 3.2 to 3.5 mm. long, 0.8 to 1.1 mm. wide; corolla 1.2 to 1.4 cm. wide in fruit; petals ovate, narrowed from above the middle to an obtuse tip, griseous-puberulous on both sides and ciliate, 3.4 to 5 mm. long, 2.5 to 3.3 mm. wide; stamens in fascicles of 3 to 5, the filaments glabrous, shorter than petals; glands oval-oblong, griseous-puberulous; styles 3 or 4, glabrous or sparsely pilose at base, united into a sparsely pubescent column; ovary depressed-conic, densely griseous-villous.

TYPE LOCALITY: Southern shore of the Rio Negro, to its junction with the Solimoes, Brazil.

ILLUSTRATION: Mart. Fl. Bras. 13¹: pl. 101, f. I.

SPECIMENS EXAMINED:

BRAZIL: Southern shore of the Rio Negro, to its junction with the Solimoes, May, 1851, *Spruce* 1489 (type collection; G). Lazco, Rio Negro, Province of Amazonas, 1874, *Traill* 341 (G).

The species was originally described from "North Brazil and Venezuela, on the upper Rio Negro abundantly, *Spruce*, nos. 1489 and 3722." Of these numbers the former is here selected as the type. The species has also been recorded by Eichler from Caracas. The stamens, according to Bentham and as shown in Eichler's figure, are sometimes as many as five in a fascicle.

14. *Homalium eleutherostylum* Blake, sp. nov.

Branchlets fuscous, subterete, in youth finely puberulous with incurved hairs and rather densely pilose with dull wide-spreading hairs 0.5 to 0.8 mm. long, in age glabrescent; leaf blades 8.2 to 14.2 cm. long, 3.3 to 5.3 cm. wide, oblong-ovate or oblong-elliptic, short-acuminate, with obtuse tip, rounded at base, chartaceous, crenate with 15 to 18 pairs of very depressed rounded teeth, above more or less shining, along costa and the 7 to 10 pairs of veins finely incurved-puberulous, elsewhere very sparsely so or subglabrous, and along costa rather sparsely spreading-pilose, beneath dull, along costa (especially toward base) spreading-pilose, along the main nerves pilosulous, barbellate in the axils, elsewhere glabrous; petioles rather densely incurved-puberulous and spreading-pilose, 5 to 7 mm. long; peduncles axillary and terminal, solitary, pubescent like the stem, 3.5 cm. long; rachis incurved-puberulous and rather sparsely pilosulous, 7.5 to 9.7 cm. long; inflorescences simply racemose, cylindric, sparsely flowered; pedicels 1.5 to 5.5 mm. long; calyx tube in fruit turbinate-campanulate, without distinct pediform base, obscurely sulcate, rather sparsely griseous-puberulous with incurved hairs; calyx segments 5 or 6, lanceolate to lance-ovate, acuminate, griseous-puberulous, 2.5 to 3.5 mm. long, 1 to 1.3 mm. wide; corolla in fruit 11 to 12.5 mm. wide; petals triangular-ovate or rhombic-ovate, obtusish, griseous-puberulous, 3.8 to 4.3 mm. long, 3 to 3.3 mm. wide; stamens in fascicles of 3 or 4, glabrous, about equaling the petals; glands oval-oblong, griseous; styles 3, distinct, slightly pubescent at base, spreading in fruit; ovary depressed-conic, griseous-villous.

Type in the Gray Herbarium, collected near Barra, Province of Rio Negro, Brazil, July, 1851, by R. Spruce (no. 1662).

The type, distributed as "*Homalium pedicellatum* var.," is so similar in most respects to *H. pedicellatum* that I was for some time inclined to refer it to that species. It differs, however, not only in the free styles but in the denser pubescence of the branches and in the fact that the less shiny leaves are pilose above along the costa.

15. *Homalium hondurense* Donn. Smith, Bot. Gaz. 20: 4. 1895.

Tree, about 10 meters high; branchlets slender, gray, lenticellate; leaf blades 11.5 to 16.5 cm. long, 5.5 to 8.7 cm. wide, oval or broadly obovate-oval, short-pointed, with acutish tip, at base cuneate or rarely rounded-cuneate, thin, papery-membranaceous, coarsely undulate-crenate with about 12 pairs of rounded depressed teeth, above very sparsely strigillose along costa or essentially glabrous, beneath sparsely barbellate in the axils of the 7 to 9 pairs of prominent-reticulate veins, otherwise glabrous; petioles essentially glabrous, 5 to 6 mm. long; peduncles axillary and terminal, solitary, glabrous, 3 to 6 cm. long; inflorescences conic-cylindric, paniculate to about the middle, then simply racemose; rachis puberulous with incurved-spreading hairs, 9 to 13.5 cm. long; lowest branches of panicle 1 to 2.5 cm. long, few-flowered; pedicels 1.5 to 7 mm. long, puberulous; fruiting calyx tube turbinate, finely incurved-puberulous, obscurely sulcate, gradually or abruptly contracted into a pediform base about half as long as the body; calyx segments 5 to 7, linear-oblong or narrowly elliptic-oblong, obtusish, griseous-puberulous, 2.2 to 3 mm. long, 0.5 to 0.8 mm. wide; corolla 11 to 13 mm. wide in fruit; petals 5 to 7, ovate, oval-ovate, or rhombic-ovate, obtuse, somewhat contracted below the middle, griseous-puberulous, 4.3 to 4.8 mm. long, 2 to 3 mm. wide; stamens in fascicles of 3, shorter than the petals, the filaments glabrous; glands oval-oblong, sulcate, griseous; styles 3, distinct, hairy at base; ovary conic, shortly griseous-villous.

TYPE LOCALITY: San Pedro Sula, Honduras.

SPECIMEN EXAMINED:

HONDURAS: Río Permejo near San Pedro Sula, Dept. Santa Bárbara, altitude 60 meters, September, 1887, *Thieme* (J. D. Smith, no. 5227; type, N).

Homalium hondurensis is most closely related to *H. columbianum*, but is easily distinguished by its pubescent leaves, larger petals, and glabrous filaments.

16. *Homalium columbianum* Blake, sp. nov.

Tree, 13 meters high, the trunk 30 cm. in diameter; older branchlets fuscous gray, the younger fuscous brown, marked with whitish lenticels, glabrous, slender; leaf blades 9.3 to 12.3 cm. long, 4.3 to 6 cm. wide, elliptic or oval, short-pointed, with obtuse tip, rounded or cuneate at base, comparatively thin, papery-membranaceous, undulate-crenate with about 12 pairs of very depressed teeth, glabrous and equally green on both sides, not barbellate in the axils, with 6 to 8 pairs of lateral veins; petioles glabrous, 7 to 10 mm. long; peduncles axillary and terminal, solitary or in pairs, glabrous, 2.5 to 6 cm. long; inflorescences slenderly conic-cylindric, paniculate; rachis finely incurved-puberulous, 12.5 to 17 cm. long; lower branches of inflorescence (peduncles of the second order) 9 to 15 mm. long, the upper gradually shorter, the lower few-flowered, the upper 1-flowered; pedicels puberulous, 1 to 2 mm. long; fruiting calyx tube turbinate, contracted gradually into a pediform base, griseous-puberulous; calyx segments 6 or 7, subulate-lanceolate or subulate, acuminate, puberulous on both sides and short-ciliate, 1.5 to 2.3 mm. long, 0.6 to 0.7 mm. wide; corolla 9 to 11 mm. wide in fruit, "white"; petals 6 or 7, ovate, narrowed from near the middle to an obtuse tip, griseous-puberulous on both sides and short-ciliate, 3.5 to 4.2 mm. long, 1.6 to 1.8 mm. wide; stamens 3 or 4 in a fascicle, the filaments pilose to middle, shorter than the petals; glands oval-oblong, griseous; styles 3, distinct, hairy at base; ovary conic, short-villous.

Type in the U. S. National Herbarium, no. 537,186, collected at San Martín de Loba, Lands of Loba, Department of Bolívar, Colombia, April to May, 1916, by H. M. Curran (no. 21).

Homalium columbianum is readily distinguished by its clusters of 3 or 4 stamens with filaments pilose to the middle. It is the first species of the genus to be reported from Colombia.

17. *Homalium trichostemon* Blake, Contr. Gray Herb. n. ser. 53: 60. 1918.

Tree, 12 meters high; older branchlets gray-barked, the younger fuscous, dotted with whitish lenticels, glabrous; leaf blades 5.7 to 11.5 cm. long, 2.8 to 4.5 cm. wide, elliptic to oval or obovate-oval, obtuse, short-pointed, or acuminate with blunt or retuse tip, cuneate or rounded at base, crenate-repand or crenate-serrate, sparsely pubescent at base of midrib above, barbellate in the axils of the veins beneath and sometimes obscurely puberulous along midrib and the 7 or 8 pairs of veins, otherwise glabrous, reticulate-venose; petioles 4 to 7 mm. long, sordid-pubescent above, glabrous beneath; racemes axillary and subterminal, simple, solitary or in pairs, the rachis loosely or somewhat densely flowered, puberulous or pilosulous, 6 to 7 cm. long; peduncles 1.5 to 3.5 cm. long, subglabrous or sparsely puberulous; pedicels 1 to 2 mm. long; fruiting calyx tube turbinate, without pediform base, 6 or 7-sulcate, griseous-puberulous; calyx segments 6 or 7, ovate-lanceolate, narrowed to an obtusish tip, griseous-puberulous and ciliate, 4 to 4.5 mm. long, 1.5 to 1.8 mm. wide; corolla 11 to 13 mm. wide; petals 6 or 7, ovate, obtuse, griseous-puberulous and ciliate, 4.8 to 5.5 mm. long, 2.5 to 2.8 mm. wide; glands griseous-puberulous; stamens in fascicles of 5 to 7, the filaments pilose to the middle, shorter than the petals; styles 3, distinct, short-pilose to the middle or higher; ovary depressed-conic, griseous-villous.

TYPE LOCALITY: Cafetal Montecristo, Department of Pochutla, Oaxaca, Mexico, at an altitude of 800 meters. Type in Gray Herbarium, collected April 11 to 12, 1917, by Conzatti, Reko & Makrinus (no. 3207).

OTHER SPECIMENS EXAMINED:

MICHOACÁN or GUERRERO: San Cristóbal, April 25, 1899, *Langlassé* 1011 (N).

OAXACA (?): Petlapa, October, 184-, *Galeotti* 7245 (N).

Langlassé describes the flowers of his plant as greenish. A plant collected between Juchitango and Ometepec, Guerrero, at an altitude of 90 to 305 meters, February 20, 1895, by E. W. Nelson (no. 2325), seems to differ from *H. trichostemon* as here described only in its glabrous filaments. Whether it represents a distinct species or a mere form of *H. trichostemon* must remain in doubt until more material of the group can be secured.

It is possible that the species above described is *Homalium senarium* Moc. & Sessé, the status of which is not yet definitely made out, but in view of the very abbreviated description of that species, too short to permit its definite identification, it does not seem advisable to adopt the latter name.

This species bears the name "palo de piedra" in Oaxaca.

18. *Homalium stenosepalum* Blake, sp. nov.

Large tree, 25 to 30 meters high; older branches grayish, dotted with raised lenticels, glabrous, the younger grayish fuscous or fuscous, dotted with whitish lenticels, glabrous or sometimes puberulous and short-villous; leaf blades 8 to 14 cm. long, 3.2 to 6 cm. wide, elliptic or oval, short-pointed or acuminate (the tip obtuse or sometimes acute), cuneate or rounded at base, thin-coriaceous or chartaceous-coriaceous, crenate with 13 to 21 pairs of blunt teeth, somewhat shining on both sides, above glabrous, beneath barbellate in the axils of the veins, otherwise glabrous or merely sparsely pubescent along the midrib, prominulous-reticulate, with 8 to 13 pairs of lateral veins; petioles glabrous or sparsely puberulous and pilose, 5 to 13 mm. long; peduncles axillary and subterminal, solitary or rarely in pairs, incurved-puberulous or subglabrous, 1 to 4.5 cm. long; panicles branched below, simply racemose above, the rachis griseous-puberulous with incurved hairs, 3.3 to 8.3 cm. long; lower branches of panicle mostly 1 to 2 cm. long; pedicels 1.5 to 5 mm. long; fruiting calyx turbinate, contracted into a pediform base, obscurely sulcate, griseous-puberulous; calyx segments 5 or 6, narrowly lanceolate or subulate-lanceolate, narrowed to an obtusish tip, griseous-puberulous, 4 to 5 mm. long, 1 to 1.3 mm. wide; corolla 1.4 to 1.7 cm. wide in fruit, "white"; petals 5 or 6, ovate, narrowed from above the middle to an obtusish tip, griseous-puberulous, 5.5 to 6.5 mm. long, 2.5 to 3 mm. wide; stamens in fascicles of 2 or 3, the filaments glabrous, much shorter than the petals; styles 3, distinct to base, pubescent at base or below the middle; ovary short-conic, short-villous.

Type in the U. S. National Herbarium, no. 676,938, collected along the Chagres River, below Gatún, Canal Zone, Panama, near sea level, February 17, 1911, by H. Pittier (no. 2804).

OTHER SPECIMENS EXAMINED:

PANAMA: Around Frijoles, Canal Zone, altitude 8 to 30 meters, February 8, 1911, *Pittier* 2693 (N). Without definite locality, Canal Zone, *Christopherson* 139 (N).

Very distinct in its large flowers and narrow sepals. The flowers are said to be ill-smelling.

19. *Homalium eurypetalum* Blake, sp. nov.

A tree, 10 meters high; older branchlets glabrous, grayish, the younger griseous-puberulous with incurved hairs, dull grayish brown; leaf blades normally 12.8 to 14 cm. long, 4.7 to 5 cm. wide, elliptic or obovate-elliptic, short-pointed, with obtuse tip, cuneate at base, crenate with rounded teeth, chartaceous, shining, above densely incurved-puberulous along midrib, elsewhere sparsely so or glabrous, beneath sparsely incurved-pubescent along midrib and veins (these about 11 pairs), barbellate in the axils of the veins; petioles densely incurved-puberulous and sparsely pilose, 8 to 10 mm. long; inflorescences axillary and subterminal, branched below,

simply racemose above, densely griseous-puberulous and sparsely short-pilose, 11.5 to 15 cm. long, on peduncles 3 to 4 cm. long; lowest branches of panicle 1 to 4.3 cm. long; pedicels 2 to 5 mm. long; fruiting calyx tube turbinate-campanulate, obscurely striate, somewhat abruptly contracted into a pediiform base, griseous-puberulous; calyx segments 5 to 7, ovate or elliptic, obtuse, griseous-puberulous, 4 to 5 mm. long, 1.8 to 2.5 mm. wide; corolla 14 to 18 mm. wide in fruit; petals elliptic or ovate-elliptic, obtuse, griseous-puberulous, 6 to 7 mm. long, 2.5 to 4 mm. wide; stamens in fascicles of 3 or 4, the filaments glabrous or sparsely pubescent at extreme base, much shorter than the petals; styles 3, distinct, pilose at base; ovary depressed-conic, griseous-villous.

Type in the U. S. National Herbarium, no. 941,440, collected in the swamp of Sierpe, Pacific slope of Costa Rica, March, 1892, by H. Pittier (no. 6817).

The type collection of this species was referred by Captain Smith¹ to *H. hondurensis*, but comparison with the type of that species, now in the National Herbarium, shows the Costa Rican plant to differ specifically in its much larger flowers, broader perianth segments, depressed-conic ovary, and more pubescent leaves.

DOUBTFUL SPECIES.

HOMALIUM SENARIUM Moc. & Sessé; DC. Prodr. 2: 54. 1825.

"Leaves ovate, coarsely dentate; racemes axillary and terminal; flowers pedicellate; stamens in 6 hexandrous fascicles." (DC. loc. cit.)

"Leaves oval-oblong, sinuate-dentate, glabrous, short-petioled; flowers subsessile, 6 to 8-merous, densely tomentose; calyx segments oblong, narrower than the petals; stamens in fascicles of 5 to 6; styles 3 to 4, distinct.

"*Hab.* Mexico, *Jurgensen* (without any number in Herb. Hook.)." (Benth. Journ. Linn. Soc. Bot. 4: 36. 1860.)

The above translated descriptions represent all that is known of this plant, in addition to the figure (*pl.* 293) in the *Calques des Dessins* of Mociño and Sessé, which shows a plant with coarsely toothed leaves, truncate-rounded at base, and suborbicular petals. Under the circumstances it does not seem wise, in view of the very indefinite nature of the original description, to attempt its identification with either *H. trichostemon* or *H. mollicellum*, the only species now known with which it could be associated.

¹ Pittier, Prim. Fl. Costar. 2¹: 105. 1898.

NEW SOUTH AMERICAN SPERMATOPHYTES COLLECTED BY H. M. CURRAN.

By S. F. BLAKE.

The following new species of flowering plants are described from collections made by Mr. H. M. Curran in the State of Bahia, Brazil, in 1915, and in the Department of Bolívar, Colombia, in the early part of 1916. The specimens collected are almost all shrubs or trees, and for the most part represent species of at least local economic value.

***Dorstenia anthuriifolia* Blake, sp. nov.**

Stem ascending from a creeping base, about 12.5 cm. long, 3 mm. thick, fuscous, finely pilosulous, sparsely clothed with the persistent stipules, not at all scabrous; leaves erect; stipules triangular-lanceolate, acuminate, persistent, erect, subcoriaceous, subglabrous, oblique, 5 to 7 mm. long; petioles channeled and striate, glabrous, naked, 8.5 to 18 cm. long; leaf blades 16 to 17 cm. long, 6.7 to 7.3 cm. wide, oval-oblong, short-attenuate, rounded or truncate-rounded at base, obscurely repand-denticulate especially at base and apex with blunt teeth, membranaceous, above dull green, apparently with a darker central area, obscurely papillate, beneath slightly paler green and glabrous, the veins about 10 pairs, whitish, flattened or slightly prominent, anastomosing toward the margin; peduncles few, solitary in the axils, glabrous, striate, 7.5 cm. long; receptacle orbicular, flattish, centrally peltate, 1.4 cm. wide, minutely puberulous beneath, with crenate-denticulate margin, subgriseous-hispidulous on the upper surface between the intermixed male and female flowers.

Type in the U. S. National Herbarium, no. 704,556, collected in forests of the Rio Grongogy Basin, State of Bahia, Brazil, at an altitude of 100 to 500 meters, October or November, 1915, by H. M. Curran (no. 130).

This species finds its nearest relative in *D. urceolata* Schott, which is described as having scabrous stem, peduncles, petioles, and under leaf surface.

***Coussapoa curranii* Blake, sp. nov.**

Woody liana, about 20 meters high; branches stout, finely hispidulous or glabrate, the bark grayish fuscous; leaves alternate, their blades 8 to 11.3 cm. long, 3 to 4.5 cm. wide, wedge-obovate, rounded or truncate-rounded, with usually emarginulate tip, narrowed from above the middle to the rounded base, thickish, pergamentaceous, entire, above light green, glabrous or nearly so, beneath paler, sparsely short-pilose with somewhat spreading hairs along the chief veins, glabrous or essentially so between them, the veins 7 to 11 pairs, straight, parallel (the lowest pair somewhat remote), impressed above, prominent beneath, the secondary and tertiary veins obscurely anastomosing, about equally inconspicuous above, the secondary beneath prominent, the tertiary rather obscure; petioles stout, shallowly channeled above, subterete beneath, puberulous with somewhat spreading hairs, 1 to 2 cm. long; peduncles clustered at tips of branches, simple or forked at apex, spreading-puberulous, 1.5 cm. long, bearing 1 to 4 heads; pistillate heads subglobose, many-flowered, 5 to 8 mm. in diameter; perigonium turbinate-subglobose, angled, densely hispidulous-puberulous on its exposed surface, 1.5 mm. long; drupes ellipsoid-subglobose, glabrous, foveolate, purplish brown above, pale below, 1.2 mm. long; style excentric.

Type in the U. S. National Herbarium, no. 704,837, collected in the forests of the Rio Grongogy Basin, State of Bahia, Brazil, at an altitude of 100 to 500 meters, October or November, 1915, by H. M. Curran (no. 8).

■ Most nearly related to *C. latifolia obovata* Miquel, which is described as with peduncles 5 cm. long, leaves with only four or five pairs of lateral veins, and glabrous perigonium. Local name "cibuero" or "gummilera."

Coccoloba cyclophylla Blake, sp. nov.

Tree, 8 meters high, with a trunk 20 cm. in diameter; branches grayish, glabrous, sulcate in drying; upper internodes 1 to 3 cm. long; sheaths close, equaling the internodes, sparsely puberulous below, papillose above, mainly deciduous; petioles stout, subterete, slightly channeled above, hirtellous toward apex, 1 to 2 cm. long; leaf blades (5.5) 9.5 to 12 cm. long, 6 to 11.3 cm. wide, suborbicular, retuse at the broadly rounded apex, broadly rounded and slightly cordate at base, entire but somewhat wavy-margined, pergamentaceous, above dull green, glabrous, finely prominulous-reticulate, beneath brownish green, prominent-reticulate, glabrous except for the hirtellous costa, axils, and chief veins, the main veins 10 to 12 pairs, prominent; straightish and subparallel, united at their arcuate tips; spikes solitary, straightish, axillary and terminal, rather loosely flowered, 7 to 14 cm. long, 4 to 6 mm. thick; peduncles hirtellous, 1 cm. long or less; rachis hirtellous; nodes about 4-flowered; bracts suborbicular, rounded, hirtellous, 1 mm. long; ochreolae scarious, hirtellous below, 1.5 to 2.5 mm. long; pedicels 1.5 to 2 mm. long, hirtellous, jointed near apex; perigonium subglobose, hirtellous, 1.6 mm. long; filaments lance-subulate, 0.6 mm. long; ovary ellipsoid-trigonous; styles 3, two-thirds as long as ovary; segments of fruiting perigonium united for about one-third their length, suborbicular.

Type in the U. S. National Herbarium, no. 537,207, collected at San Martín de Loba and vicinity, Lands of Loba, Department of Bolívar, Colombia, April or May, 1916, by H. M. Curran (no. 47).

Nearest to *Coccoloba rotundifolia* Meisn. of Santo Domingo, which has smaller, more deeply cordate leaves mostly broader than long, with only 6 or 7 pairs of nerves, less prominently reticulate beneath, and with the costa puberulous on the upper surface of the leaf.

Ruprechtia oxyphylla Blake, sp. nov.

Shrub or more probably small tree, much branched; branches grayish, glabrous; sheaths slightly loose, truncate, subcoriaceous, sparsely hispid-strigose, persistent, 1.5 to 2.5 mm. long; petioles rounded beneath, flattish above, sparsely strigose and sometimes hirtellous on margin, 2.5 to 5 mm. long; leaf blades 4.5 to 9 cm. long, 1.5 to 4.2 cm. wide, ovate-lanceolate to elliptic-lanceolate or elliptic-ovate, acute or acuminate and usually slightly falcate, the extreme tip obtuse, rounded or cuneate at base, somewhat inequilateral, repand or subentire, chartaceous, above green, in age pale, somewhat papillose but subglabrous, beneath scarcely paler green or in age rufescent, usually sparsely hispid-pilose along the costa and chief nerves or subglabrous, but sometimes subdensely hispid-pilose over the whole under surface; chief veins 10 to 13 pairs, like the veinlets obscure above or in age prominulous, beneath prominulous, slightly curved, in age like the secondaries prominulous-reticulate, the tertiaries obscure or slightly prominulous in age; staminate spikes in clusters of 2 to 4 on the growth of the previous season, 1 to 1.5 cm. long, 5 to 7 mm. thick, densely flowered, the axis densely hirtellous with dull whitish hairs; flowers in clusters of 2 to 4; pedicels 2.5 to 3 mm. long, articulate well above the middle, sparsely hirtellous; perianth 2.8 mm. long, 6-parted nearly to base, the very short tube sparsely hirtous, the segments elliptic, subtruncate, short-ciliate, glabrous or sparsely hirtellous dorsally; stamens 8, the slenderly subulate filaments glabrous, 3.5 to 4 mm. long, the anthers 1 mm. long, the ovary rudiment hispid; pistillate spikes from the previous season's growth, solitary in the axils, the axis 2.8 cm. long or less,

hirtellous, rather densely flowered; flowers in clusters of 1 to 3 at the nodes; pedicels hirtous or hirtellous, 3 to 4 mm. long, articulate near the middle; fruiting perianth 1.7 to 2.3 cm. long, the turbinate-campanulate tube (3.5 to 4 mm. long) and the base of the lobes densely strigose-pilose; outer segments spatulate-linear, only slightly broadened toward the rounded or subtruncate tip, 3-nerved and reticulate, hispidulous above with ascending hairs, 1.8 to 2 mm. wide at base, 2.8 to 3.3 mm. wide near apex; inner segments linear or linear-subulate, acuminate, at tip acute or obtusish, hirtellous, 4 mm. long, attached to base of tube for about 0.5 mm.; achene conic-ovoid, trigonous, deeply 3-grooved, the faces slightly rounded, pilosulous from apex to below the middle, 8 mm. long, 2.6 to 3 mm. thick.

Type in the U. S. National Herbarium, no. 537,606, collected on hills above Santa Marta Bay, Santa Marta, Colombia, June, 1916, by H. M. Curran.

ADDITIONAL SPECIMENS EXAMINED:

COLOMBIA: Santa Marta, altitude 305 meters, December, 1898–1901, *Herbert H. Smith* 802. Santa Marta, altitude 45 meters, January, 1898–1901, *Herbert H. Smith* 1932.

The specimens collected by Smith have been distributed as *Ruprechtia tenuiflora* Benth., but that is described as with veinless perianth segments and setiform inner calyx lobes 1 line (2 mm.) long. The species belongs to the section *Pseudotriplaris* Benth. & Hook., as do the two species from Curaçao and Venezuela recently described by the writer¹ and inadvertently referred to the section *Euruprechtia* (of Meisn., not of Benth. & Hook.).

***Ruprechtia coriacea* (Karst.) Blake.**

Triplaris coriacea Karst. Fl. Columb. 2: 131. pl. 169. 1862–1869.

This species is rather closely related, according to Karsten's description and plate, to *R. oxyphylla*, but has a larger fruiting calyx with broader acutish outer lobes. It was described from the provinces of Barcelona and Caracas, Venezuela.

***Triplaris euryphylla* Blake, sp. nov.**

Dioecious tree, 6 meters high, the trunk 10 cm. in diameter; branches dull fuscous or grayish, stout, striatulate, sparsely pilose with ascending stiffish hairs, in age glabrate; sheath bases persistent, very narrow; petioles broad, very strongly flattened, puberulous and strigose-pilose on margin, in age glabrate, 1.5 to 2 cm. long, up to 5 mm. wide; leaf blades 23 to 27 cm. long, 14 to 17 cm. wide, oval, abruptly short-pointed (the points 3 to 4 mm. long), very broadly rounded at base, entire, scarcely undulate, chartaceous, above dull green, in youth evenly but rather sparsely pilose with loose hairs, along the costa densely strigillose, in age glabrate or subglabrate except along costa, beneath not paler, similarly pubescent with stiffer, more spreading hairs, the lateral veins about 24 pairs, like the secondaries slightly prominulous above, strongly so beneath, straightish to near the margin, there arched and anastomosing; leaves near the inflorescence much smaller, the blades 13 cm. long, 6 to 6.5 cm. wide, acute at both ends; staminate inflorescences axillary and terminal, 3 to 5-branched from the base, 15 to 17 cm. long, the common peduncle about 1 cm. long, like the slender, rather loosely flowered branches densely sordid-pilose with loosely spreading or ascending hairs and densely puberulous beneath them; bracts scarious, orbicular, rounded at apex, hispid-pilose on back, 2.5 mm. long; flowers about 4 in the axils of the bracts, their pedicels about 1.3 mm. long; perianth 5-parted, 1.5 to 2 mm. long, the tube 0.5 mm. long, the segments elliptic, ciliolate; stamens apparently 8; pistillate inflorescences axillary and terminal, stiff, 3 or 4-branched from near the base, 16.5 to 18.5 cm. long, densely and rather softly pilose with ascending or spreading sordid hairs and densely puberulous beneath them; bracts ovate, acute or obtusish, densely dull-pilose and pilosulous outside with ascending or appressed hairs, glabrous inside, 5 to

¹ Blake, Contr. Gray Herb. n. ser. 53: 30–31. 1918.

7.5 mm. long, short-stipitate; pedicels about 2 mm. long; fruiting perianth 3.8 to 4.1 cm. long, the trigonous-urceolate tube 1.2 cm. long, densely pilose and pilosulous with sordid hairs, the long ones loosely ascending or spreading and with enlarged subglandular base, the short ones appressed; outer perianth segments spatulate, obtuse, broadest above the middle, appressed-pilose and spreading-ciliate, scarious, triplinerved and and reticulate, 2.6 to 2.9 cm. long, 6 to 7.5 mm. wide; inner segments lance-spatulate, obtusish, reticulate-veined, attached to the tube only at its base, clawed, 7 mm. long, 1.4 mm. wide; achene ovoid-trigonous, mucronate, glabrous, shining, olivaceous, 9 mm. long, 4.5 mm. wide; stigmas 3, 3 mm. long.

Type in the U. S. National Herbarium, no. 537,171, collected at San Martín de Loba and vicinity, Lands of Loba, Department of Bolívar, Colombia, April or May, 1916, by H. M. Curran (no. 5). Curran's no. 4, from the same locality, represents the staminate plant.

This species is said to bear the same local name, "palo santo," as the related *Triplaris laxa*, which comes from the same region. It is especially distinguished by its very broad leaves.

***Triplaris laxa* Blake, sp. nov.**

Dioecious tree, 8 meters high, the trunk 10 cm. in diameter; branches stoutish, dull fuscous, striatulate, pilose with sordid, erect or ascending, soft hairs, in age glabrate; sheath bases persistent, very narrow, glabrate or sparsely strigose; petioles strongly flattened, obscurely puberulous, strigose-pilose on margin and sparsely beneath with sordid hairs, 1 cm. long; leaf blades 20 to 23 cm. long, 5 to 9.5 cm. wide, elliptic, acute to acuminate at each end, blunt at tip, scarcely undulate, subchartaceous, brownish green when dry, above evenly but rather sparsely pilose with dull ascending hairs, more densely short-pilose along the costa and the scarcely prominulous veins, beneath scarcely paler, similarly but more densely pubescent with looser hairs, those of the costa more appressed; lateral veins about 22 pairs, beneath prominulous, straightish, parallel, toward margin arched and anastomosing, the secondaries oblique, obscurely prominulous; pistillate inflorescences axillary and terminal, loose, simple, or 3-branched from near the base, up to 38 cm. long (including the 3 to 4 cm. long peduncle), densely and softly pilose with loosely ascending or spreading dull hairs and beneath these densely puberulous, rather loosely flowered; bracts ovate, acuminate, somewhat convolute, densely and dully pilose outside, glabrous and green inside, 5 to 6 mm. long; pedicels densely pilosulous, about 3 mm. long, jointed near the middle; fruiting perianth 3.7 to 4 cm. long, scarious, the tube 1 cm. long, trigonous-urceolate, densely and dully pilose, the ascending hairs with slightly swollen bases; outer perianth segments spatulate-oblongate, obtuse, strigose-pilose on both sides, 3-nerved and reticulate, the two lateral veins evanescent above the middle, 2.7 to 3 cm. long, 6 to 7 mm. wide above the middle; inner perianth segments ovate-lanceolate, obtuse, with clawlike base, reticulate-veined, sparsely strigillose below, borne at the base of the perianth tube and united to it only at extreme base, 5 to 6 mm. long, 1.7 mm. wide; achene olivaceous, glabrous, shining, trigonous-ovoid, mucronate by the persistent style base, slightly grooved on the sides, 8 mm. long, 4 to 4.3 mm. wide; stigmas 3, 1.8 mm. long.

Type in the U. S. National Herbarium, no. 537,185, collected at San Martín de Loba and vicinity, Lands of Loba, Department of Bolívar, Colombia, April or May, 1916, by H. M. Curran (no. 20).

The local name of this tree is given by its collector as "palo santo," and the flowers are said to be white.

***Schizolobium parahybum* (Vell.) Blake.**

Cassia parahyba Vell. Fl. Flum. 168. 1825; Icon. 4: pl. 71. 1827.

Schizolobium excelsum Vog. Linnaea 11: 399. 1837.

"*Caesalpinia parahyba* Allem. Trab. Soc. Velloz. 56. 1852?"

This species was collected in flower and fruit in the Rio Grongogy Basin, Bahia, Brazil, in 1915, by Mr. Curran (no. 13). It is said to be a tree about 30 meters high, with a trunk 45 cm. in diameter, and to bear the vernacular name "pau de vintem."

Respecting the combination above made, it may be observed that the figure of Vellozo is unusually good for the work in which it appears, and thoroughly characteristic of the species. The specific name, obviously derived from the habitat of the species, "ad ripas fluvii Parahyba dicti," is written by Vellozo with a lower-case initial and is consequently to be treated as an adjective requiring modification in termination under the new combination here proposed.

***Guarea racemiformis* Blake, sp. nov.**

Tree, 5 meters high, the trunk 10 cm. in diameter; older branches dull gray, glabrate, the younger fuscous, strigillose; petioles sulcate above, rounded beneath, rather densely dull-strigillose, 2 to 3.2 cm. long; rachis similar, 4 to 7.5 cm. long, terminated by a plumule; leaflets 4 pairs, opposite, the lowest pair 4 cm. long, 2.2 cm. wide, the middle and upper 8 to 10.3 cm. long, 3.2 to 4 cm. wide, on sparsely strigillose petiolules 2 to 4 mm. long, oblong-elliptic, short-pointed, blunt at the tip, cuneate or rounded-cuneate and subequal at base, entire, pergamentaceous, somewhat pellucid-punctate, above obscurely strigillose, at length glabrate, beneath obscurely and sparsely strigillose along the costa and chief veins, otherwise glabrous, the costa impressed above, prominulous beneath like the 6 to 9 ascending lateral veins and the reticulate secondaries; peduncles axillary and on the previous year's wood, strigillose, 5 to 7 mm. long; rachis 2.5 to 7 cm. long; panicles racemiform, slenderly cylindric, 1.5 to 1.8 cm. thick, the branches very short, 2 or 3-flowered; pedicels 0.6 mm. long or less; calyx cup-shaped, 2.5 mm. long, very sparsely strigillose, somewhat spathaceous, splitting irregularly into 3 or 4 lobes, these deltoid, obtuse, tufted-ciliolate at apex; petals 4 or 5, oblong-oval, obtuse, densely subsericeous-strigose without, glabrous within, 6 mm. long; staminal tube shorter than petals, glabrous on both sides except for the ciliolate apex, entire; anthers 8 to 10, borne inside the tube below its apex, subsessile, oblong-obovate, truncate, glabrous, 1 mm. long; disk stipitiform, glabrous; ovary sparsely hispid-strigose with yellowish hairs above the middle, 4-celled, the cells 1-ovuled; style about twice as long as ovary, rather sparsely hispid-strigose nearly to apex; stigma flat, circular.

Type in the U. S. National Herbarium, no. 537,250, collected in the vicinity of San Martín de Loba, Lands of Loba, Department of Bolívar, Colombia, April or May, 1916, by H. M. Curran (no. 96).

A species noteworthy for the occurrence of both 4 and 5-merous flowers, and for the fact that the racemiform panicles on the same specimen occur both in the axils of leaves of the year and from axils on the branchlets of the preceding year.

***Trichilia alta* Blake, sp. nov.**

Tree, 30 meters high, the trunk 50 cm. in diameter, the branches grayish brown, in youth densely strigillose, in age glabrescent; petioles stoutish, sulcate above like the rachis, rather densely strigose, 1 to 1.5 cm. long; rachis 4.5 cm. long, puberulous with spreading sordid hairs; leaflets 7 to 9, alternate, 8 to 9.5 cm. long, 2.7 to 4 cm. wide (the terminal leaflet largest), elliptic or obovate-elliptic, acuminate, rounded at base, entire, thinly coriaceous, puberulous along costa and veins above, otherwise glabrous, rather densely puberulous with spreading hairs along the costa beneath, strigose or strigillose along the veins and sparsely between them, dull green above, fuscous beneath when dry, the lateral veins about 15 pairs, like the costa impressed above, prominulous beneath, the venation otherwise obscure; petiolules densely strigillose, 1 to 2.8 mm. long; panicles axillary, solitary or in pairs, pyramidal or conic, branched from near the base, densely short-pubescent with short, dull, appressed or ascending hairs, 2.5 to 4 cm. long, 1.8 to 3.3 cm. wide; peduncles 3 to 20 mm. long; cymules 1 to 3-flowered; pedicels 1 mm. long, sordid-puberulous; calyx 5-lobed for

about half its length, flattish, 2.5 mm. wide, griseous-strigillose and ciliolate, the lobes broadly deltoid, obtuse or acutish, about 0.6 mm. long, 1.3 mm. wide; corolla valvate in aestivation; petals 5, ovate, acutish, griseous-strigillose outside, minutely papillose-puberulous within along margin and toward the acutish tip, 2.8 mm. long (in buds, not quite mature), 1.2 mm. wide; filaments united to apex, the staminal tube glabrous on both sides, the teeth lanceolate, 0.2 mm. long; anthers papillose, oval, 0.8 to 1 mm. long; longer stamens 2.4 mm. long, the alternate shorter, 1.8 mm. long; pistil about equaling the stamens; disk very short, crenate, glabrous; ovary conic, densely strigose, 3-celled; style columnar, glabrous, about half as long as ovary; stigma about as wide as style.

Type in the U. S. National Herbarium, no. 704,857, collected in forests of Rio Grongoy Basin, Bahia, Brazil, at an altitude of 100 to 500 meters, October or November, 1915, by H. M. Curran (no. 56).

This species belongs to the section *Moschoxylum*, and is perhaps most nearly related to *T. catigna* A. Juss. Its local name is "pau rosa branca," according to the collector.

***Trichilia curranii* Blake, sp. nov.**

Shrub or tree; branchlets pale brown, strigillose; petiole subterete, sulcate above, densely griseous-strigillose, 1.5 cm. long; rachis finely puberulous with spreading hairs and sparsely strigose, sulcate above, 6.7 to 12.5 cm. long; leaflets 11, opposite or subopposite below, alternate above, the lower 5.7 to 6.5 cm. long, 1.5 to 2.3 cm. wide, elliptic or oblong-elliptic, rather abruptly acuminate, at base rounded or rounded-cuneate and inequilateral, entire, subchartaceous, puberulous along costa above, otherwise glabrous, beneath strigose and strigillose along costa and veins and very sparsely over the surface, with 9 to 14 pairs of lateral veins, these like the costa impressed above, prominulous beneath; petiolules strigillose, 1.5 to 2.5 mm. long; upper and terminal leaflets obovate, somewhat abruptly acuminate, at base acute or acuminate, 9.7 to 15.5 cm. long, 2.8 to 4.5 cm. wide; peduncles axillary, solitary, strigose and finely puberulous, 3 to 5 cm. long; panicles pyramidal, 8.5 to 15 cm. long, 8 to 12 cm. wide, puberulous and strigose, the branches and branchlets spreading-hirtellous; cymules 3 to 5-flowered; pedicels 1 to 2 mm. long; calyx sparsely strigillose and ciliolate, 2 mm. wide, 5-lobed for about one-third its length, the lobes broadly deltoid, obtuse or acute, about 0.4 mm. long, 1.2 mm. wide; petals 5, ovate, acutish, quincuncial in aestivation, sparsely strigillose outside, 2.4 mm. long, 1.2 mm. wide; disk obscure; staminal tube with stamens 2 mm. long; filaments united to apex, the tube glabrous outside, short-pubescent within; anthers ovate, obtuse, papillose; pistil slightly shorter than stamens; ovary short-conic, densely short-strigose; style glabrous, one-fifth to one-fourth as long as ovary; stigma truncate.

Type in the U. S. National Herbarium, no. 537,584, collected at San Martín de Loba and vicinity, Lands of Loba, Department of Bolívar, Colombia, April or May, 1916, by H. M. Curran.

Trichilia curranii seems to be most nearly related to *T. verrucosa* (Karst.) C. DC., but differs in its more numerous leaflets and its pubescence, as well as in other characters.

***Trichilia microdonta* Blake, sp. nov.**

Tree; older branchlets gray or fuscous gray, glabrous; younger branchlets fuscous, angulate, sparsely sordid-strigose and strigillose; petioles flattened above, rounded beneath, densely sordid-strigose and strigillose, 2 to 5 mm. long; rachis similar, glabrescent above the base, 4.5 to 8.3 cm. long; leaflets 11, subopposite or the upper alternate; lowest 2 or 3 pairs strongly reduced, 3.5 to 16 mm. long, 1 to 9 mm. wide, subulate and stipuliform and without distinct blade or oval and petioluled, their petiolules 3.5 mm. long or obscure; upper leaflets 6.2 to 10 cm. long, 2.8 to 4.2 cm. wide, on petiolules 3 to 6 mm. long, oval or oval-obovate, short-pointed but obtuse or emarginulate at tip, cuneate or rounded-cuneate and oblique at base, entire, rather thinly coriaceous, above dull green, sparsely hispidulous along costa, in age glabrate, beneath

somewhat paler, sparsely hispidulous or subglabrate, the costa and the 10 to 13 pairs of nerves prominulous beneath, the secondaries obscure; terminal leaflet similar but somewhat larger; peduncles axillary and terminal, flattened, sparsely strigose or hispidulous, 5 to 7 cm. long; panicles subcylindric, 5.5 to 9 cm. long, 2.5 to 3.5 cm. wide, sparsely hispidulous, their branchlets erect or divergent; cymules about 3 to 5-flowered; pedicels 1.5 to 2.8 mm. long; calyx cup-shaped, very sparsely hispidulous, 1.7 mm. long, very shallowly 5-toothed, the teeth broadly deltoid, obtuse or acutish; corolla 5-parted (rarely and abnormally 6-parted), 3.2 mm. long, very sparsely strigose outside, the segments valvate in aestivation, connate below, ovate or lance-ovate, obtusish, puberulous along margin; stamens 10; anthers united to apex, the tube about 1 mm. long, glabrous outside, sparsely pilose inside toward apex, bearing 10 slender teeth between the anthers; anthers lance-oblong, obtuse, glabrous, about 1 mm. long, the alternate ones slightly smaller; ovary densely strigose, 3-celled, the ovules 2 in each cell, collateral; style very short, glabrous; stigma capitate.

Type in the U. S. National Herbarium, no. 704,513, collected in forests of the Rio Grongogy Basin, Bahia, Brazil, October or November, 1915, by H. M. Curran (no. 81).

This species is apparently most closely related to the Colombian *T. appendiculata* (Triana & Planch.) C. DC., of the section *Moschoxylum*, but differs in its much smaller, very sparsely strigose corolla and very short style, and in having the staminal tube sparsely pilose within toward the apex.

***Trichilia triphylla* Blake, sp. nov.**

Tree or shrub; older branchlets grayish fuscous, dotted with whitish lenticels, finely puberulous and sparsely strigose, the younger dull gray, more or less densely sordid-strigose and strigillose; petioles flattened and broadly channeled above, rounded beneath, sparsely pubescent above, densely sordid-strigose beneath, 1.5 to 2 cm. long; rachis subterete or obscurely flattened above, puberulous and strigose, 7 to 17 mm. long; leaflets 3 or rarely and abnormally 4, the two lower opposite or subopposite, 4 to 11 cm. long, 2.5 to 4.5 cm. wide, oval or oblong-elliptic, rarely ovate, usually acute or short-pointed, rounded and unequal at base, subpapyraceous, entire, puberulous along the impressed costa above, otherwise glabrous, beneath finely puberulous and sparsely strigose or hispid along the costa and chief veins, otherwise glabrous or subglabrous, the 9 to 13 pairs of primary veins obscure above, ascending, prominulous beneath, the secondaries reticulate and prominulous on both sides; petiolules 2.5 to 7 mm. long, finely puberulous and sparsely hispid or strigose; terminal leaflet similar but considerably larger, 7.5 to 15 cm. long, 4 to 7.2 cm. wide, on a petiolule 2 to 7 mm. long; peduncles axillary, strigillose and strigose, 3 to 7 mm. long, or almost none; panicles pyramidal, usually trifid, 1.2 to 3.5 cm. long, 1 to 3 cm. wide, hispid and strigose, rather few-flowered; pedicels 2 to 3.5 mm. long; calyx saucer-shaped, strigose, obscurely 4-denticulate, 1.2 mm. long; corolla 4-parted to the base, 4.5 to 5.5 mm. long, sparsely strigillose, the petals oblong-oval, imbricate in aestivation; androecium shorter than corolla, the filaments connate to middle in a glabrous tube, the free portions densely hispid-pilose inside and on margin; stamens 10; anthers short, pilose; disk prominent, fleshy, lobulate, pilose; ovary densely hispid-pilose; style densely hispid-pilose, twice as long as ovary; stigma subcapitate; fruit globose-ovoid, mucronulate, densely hispid-strigose with dull hairs, 5 to 6 mm. long, 3-valved, 1-seeded.

Type in the U. S. National Herbarium, no. 537,441, collected in the vicinity of Estrella, Caño Papayal, Lands of Loba, Department of Bolívar, Colombia, in April or May, 1916, by H. M. Curran (no. 299). Also collected in fruit by Mr. Curran in the same vicinity (no. 315).

Trichilia triphylla is a member of the section *Eutrichilia* and most nearly related to *T. goudotiana* Triana & Planch., also a Colombian species. From that species, as described, it differs in its pubescent petioles and sparsely pubescent leaves, its much larger flowers, and its densely pubescent style.

Fischeria blepharopetala Blake, sp. nov.

Presumably a scandent shrub; stem stoutish, terete, fuscous or greenish, hispid with spreading septate sordid hairs with scarcely enlarged bases, and finely stipitate-glandular and hispidulous; leaves opposite, their blades 8.5 to 22.5 cm. long, 3.8 to 11.5 cm. wide, elliptic, short-pointed (the narrow apex 4 to 6 mm. long), at base somewhat narrowed and cordate, with the sinus closed or sometimes open, thin, entire, above dull green, evenly and rather densely hispid and hispidulous with incurved or somewhat spreading hairs, hispid along the midrib and veins, beneath rather densely pilose with spreading hairs with enlarged bases, along the veins hispid and stipitate-glandular, reticulate-veined beneath (lateral veins 7 to 9 pairs, arched-anastomosing toward the margin); petioles densely hispid and stipitate-glandular, 1.2 to 3.5 cm. long; peduncles solitary in the axils, hispid and stipitate-glandular, 5.5 to 13 cm. long, bearing about 6 to 9 flowers in a racemosely arranged corymb, the pedicels 2 to 4 cm. long, pubescent like the peduncle; sepals 5, lance-subulate, acuminate almost from the base, ciliolate, sparsely hispid and glandular, 7.5 to 12 mm. long, 1 to 3.5 mm. wide; corolla 1.6 to 2.1 cm. wide, deeply 5-parted, the lobes elliptic-ovate, obtuse, slightly contracted at base, somewhat crisped, undulate-crested on one side below the apex, strongly veined, thinner toward the margins, long-ciliate, hispid-pilose outside, except on the membranous margin, and inside below the middle; outer corona thick, fleshy, adnate to gynostegium and about half as high, subentire; inner corona of 5 thick fleshy deltoid-oval rounded lobes equaling the gynostegium; anther appendages deltoid, broadly rounded, appressed.

Type in the U. S. National Herbarium, no. 537,379, collected at San Martín de Loba and vicinity, Lands of Loba, Department of Bolívar, Colombia, April or May, 1916, by H. M. Curran (no. 206).

ADDITIONAL SPECIMEN EXAMINED.

COLOMBIA: Santa Marta, 1898-1901, *Herbert H. Smith* 2090.

Smith's specimens were distributed as *F. calycina* Decaisne. That species, however, is described as having lanceolate-attenuate petals, puberulous on both sides and sulcate-plicate in the middle.

Macroscepis barbata Blake, sp. nov.

Scandent; stem stout, 2.5 to 3.5 mm. thick, densely puberulous and hispid-pilose with spreading several-celled fulvous hairs; leaves opposite, the blades 11.5 to 13.5 cm. long, 7.5 to 9 cm. wide, broadly obovate-oval, abruptly short-pointed, narrowed from above the middle to a deeply cordate base, dark green above, pale green beneath, thin and membranaceous, with 6 to 10 pairs of ascending lateral veins, rather densely hispid-pilose on both sides with fulvous hairs, these longer along the veins, somewhat harsh above, soft beneath; petioles stout, 1.5 to 1.8 cm. long, densely pubescent like the stem, the short hairs glanduliform; umbels solitary in the axils, about 6-flowered; peduncles 1 to 2 cm. long, pubescent like the stem; pedicels 6 to 8 mm. long; bracts lance-subulate, acuminate, about 1 cm. long; calyx 5-parted almost to the base, the segments ovate, acute, fulvous-setulose and glandular-puberulous on back, hispid-pilose on margin, glabrous within, 14 mm. long, 7.5 mm. wide; glands none; corolla salverform, greenish, the urceolate tube glabrous outside except for the sparsely hirtellous apex, inside glabrous except for the densely hirtellous apex, 12 to 14 mm. long, 8 mm. in diameter; limb 5-lobed for about three-fifths the way to base, 2.8 to 3.5 cm. wide, with small orifice (about 2.5 mm. in diameter), sparsely hirtellous and glandular-puberulous outside, inside grading from densely papillose on margin to densely hirtellous at center, the lobes deltoid-ovate, emarginate at the broadly rounded apex, somewhat repand, dark green with narrow pale margin, 8 to 11 mm. long, 11 to 13 mm. wide; corona adnate to the corolla tube, produced below the apex of the latter into 5 rounded, emarginate, somewhat bilobed and fluted, fleshy appendages alternating with the corolla lobes; anthers with deltoid-ovate, broadly rounded,

inflexed, membranous appendages; stigma pentagonal, slightly concave; fruit not known.

Type in the U. S. National Herbarium, no. 537,342, collected at San Martín de Loba and vicinity, Lands of Loba, Department of Bolívar, Colombia, April or May, 1916, by H. M. Curran (no. 182).

Macroscelis urceolata Karst., the only other species of the genus with a similar corolla, is distinguished by having the limb of the latter fulvous-hispid inside instead of merely papillose or hirtellous as in this species.

THE NORTH AMERICAN SPECIES OF ASTERELLA.

BY ALEXANDER W. EVANS.

INTRODUCTION.

The genus *Asterella* was published by Palisot de Beauvois, probably in 1805,¹ and was based on the two Dillenian species, "Lichen pileatus parvus carinatus, capitulis fimbriatis" and "Lichen pileatus parvus, foliis crenatis."² In the first edition of his *Species Plantarum* (1753) Linnaeus had recognized both of these species and had included them in his composite genus *Marchantia*, giving them the binomial names *M. tenella* and *M. hemisphaerica*. Palisot de Beauvois accepted these specific names and designated his two species *Asterella tenella* and *A. hemisphaerica*. According to modern ideas the genus as originally defined was a composite, its two species no longer being considered congeneric. In spite of this fact it was adequately published and deserves recognition in a restricted sense, if the current rules of nomenclature are followed. Botanists, however, persistently ignored its claims for over 50 years, and many refuse to admit their validity even at the present time. This is due partly to the confusion caused by Lindberg and Trevisan in their attempts to reestablish the genus and partly to the fact that two other genera, proposed for the reception of the Linnaean *M. tenella* and *M. hemisphaerica*, had come in wide use.

The genera in question are *Reboulia* and *Fimbriaria*. *Reboulia* was published by Raddi in 1818³ and was based on *M. hemisphaerica*; *Fimbriaria* was published by Nees von Esenbeck in 1820⁴ and included *M. tenella* and three other species. If Raddi had known of Palisot de Beauvois's genus and had recognized its composite nature, the establishment of a new genus upon either of its component species

¹ Lam. Dict. Sci. Nat. 3: 257. 1805 (?). This citation has been kindly supplied by Dr. John Hendley Barnhart, of the New York Botanical Garden. Dr. Barnhart states that the date is somewhat doubtful but that the volume cited could not have been published later than 1806.

² Hist. Musc. 521. pl. 75, f. 4; 519. pl. 75, f. 2. 1741.

³ Opusc. Sci. Bologna 2: 357. 1818. The name was originally spelled "*Rebouillia*."

⁴ Hor. Phys. Berol. 44. 1820. The name was originally spelled "*Fimbraria*."

would have been a perfectly justifiable procedure, and the name *Asterella* would naturally have been reserved for the remaining species. Even in the absence of such knowledge the retention of the name for *A. tenella* is logically demanded, according to the Vienna Rules, since *Reboulia* preceded *Fimbriaria* by two years. Nees von Esenbeck's genus would then naturally lapse into synonymy, since the other species included in *Fimbriaria* are all congeneric with *A. tenella*. These conclusions seem inevitable and were clearly stated by Underwood¹ over 20 years ago.

Unfortunately Lindberg,² when he revived the genus *Asterella* in 1868, restricted the name to *A. hemisphaerica* instead of to *A. tenella*, although he gives no reason for so doing. Six years later Trevisan,³ in ignorance of Lindberg's action, revived *Asterella* independently, referring to it five species, all congeneric with *A. tenella*. Soon afterwards, however, upon learning of Lindberg's work, he adopted the genus *Asterella* in the Lindbergian sense and revived Corda's genus *Hypenatron* for *A. tenella* and its allies,⁴ the name *Fimbriaria* in his opinion being untenable. At almost the same time Lindberg⁵ also changed, and used *Asterella* in the sense originally suggested by Trevisan (that is, for *A. tenella* and its allies), the name *Reboulia* thus again becoming available for *A. hemisphaerica*. These facts are set forth with much ridicule by Le Jolis,⁶ who advocates the abandonment of the name *Asterella* altogether on account of the different senses in which it has been used, not only by different writers but by the same writers at different times. His arguments would perhaps have more weight if Palisot de Beauvois himself, rather than his successors, had been responsible for the confusion. Since this is not the case, there seem to be no adequate reasons for giving up the name but many good reasons for retaining it in the sense originally suggested by Trevisan, a course which recent writers in America and Scandinavia have consistently maintained. At the same time most European writers still prefer *Fimbriaria*; and both Stephani and Schiffner, at the Brussels Congress in 1910, definitely recommended that *Fimbriaria* and *Reboulia* be placed among the *nomina conservanda*, to the exclusion of *Asterella*.

Of the four species originally assigned to *Fimbriaria* the first, which may be regarded as the type of the genus, was the African *F. marginata* Nees, the remaining species being *F. fragrans* Nees, *F. saccata* (Wahl.) Nees, and *F. tenella* (L.) Nees. During the next

¹ Bot. Gaz. 20: 59. 1895.

² Not. Sällsk. Faun. Fl. Fenn. Förh. 9: 286. 1868.

³ Rend. Ist. Lombardo II. 7: 785. 1874.

⁴ Mem. Ist. Lombardo III. 4: 440. 1877.

⁵ Hep. Utveckl. 49. 1877.

⁶ Mém. Soc. Sci. Nat. Cherbourg 29: 131. 1895.

quarter century the genus gradually increased in size, partly through the transfer of species from other genera and partly through the addition of new species. When the *Synopsis Hepaticarum* was published in 1847 the number of species recognized had grown to 24. Five of these were recorded from Europe only, 4 from Africa, 7 from Asia, and 2 each from North America, South America, and Australasia; the two remaining species were reported from both Europe and North America, one of them also from Asia. When Stephani published his monograph of the genus in 1899,¹ the number of species, in spite of certain reductions to synonymy, had more than doubled, 69 being recognized. Three of these are recorded from Europe only, 14 from Africa, 15 from Asia, 16 from North America, 7 from South America, and 11 from Australasia and the Hawaiian Islands; the remaining three species are reported from both Europe and North America, one being reported in addition from Asia, and one from South America. According to the records at hand 28 species, 5 from Africa, 11 from Asia, 3 from North America, 3 from South America, and 6 from the Pacific islands, have been published since 1899, thus raising the total to 97. The majority of these additions were made by Stephani in the sixth volume of his *Species Hepaticarum* (1917). The writer hopes to show, however, that several of the species recognized by Stephani should be reduced to synonymy, and it is possible that others deserve the same fate.

Trevisan's attempt to replace *Fimbriaria* by *Hypenantron* was based on the existence of an older algal genus *Fimbriaria*, published by Stackhouse in 1809. Since this name was soon repudiated by its author and has been ignored by practically all later algologists, Le Jolis claims that it has no nomenclatorial standing, and that it ought not to stand in the way of maintaining *Fimbriaria* Nees as a valid genus. Fortunately the adoption of *Asterella* makes it unnecessary to decide this point. *Hypenantron* as originally described by Corda² contained a single species, the Swiss *H. ciliatum*. Since no description of this species is given, other than that included in the generic diagnosis, its identity would be in doubt if Nees von Esenbeck³ had not listed it among the synonyms of *Fimbriaria fragrans*. Following the example of Trevisan, certain European writers recognized *Hypenantron* for a while, but it enjoyed a short-lived vogue and has few or no adherents at the present time.

Two other synonyms, *Rhacotheca* Bisch. of 1844⁴ and *Octoskepos* Griffith of 1849,⁵ remain to be considered. *Rhacotheca* was based on

¹ Bull. Herb. Bolss. 7: 84-110, 198-214. 1899.

² Oplz, Beitr. Naturg. 648. 1828.

³ Naturg. Eur. Leberm. 4: 268. 1838.

⁴ Seubert, Fl. Azor. 12. pl. 14. 1844.

⁵ Not. Pl. Asiat. 2: 343; Icon. Pl. Asiat. 2: pl. 69D, f. 1 1849.

a single species of the Azores, *R. azorica* Bisch., and was admitted into the Synopsis Hepaticarum and several subsequent works. Schiffer reduced the genus to synonymy in 1893,¹ and its single species is now considered identical with *Fimbriaria africana* Mont., or *Asterella africana* (Mont.) Underw., as it should be called, a species known from Madeira, the Canary Islands, and Algeria, as well as from the Azores. *Octoskepos* was likewise a monotypic genus, being based on *O. khasianus* Griffith, of the Himalayas. Mitten, in 1861,² reduced it to synonymy under *Fimbriaria*, to which genus he transferred the single species, and it is retained in this position by Stephani.

Of the North American species recognized by Stephani in his monograph the following eight were originally described by American writers: *A. bolanderi*, *A. palmeri*, and *A. violacea* by Austin; *A. austini*, *A. pringlei*, and *A. wrightii* by Underwood; *A. lateralis* and *A. nudata* by Howe. The remaining species were all described by Europeans. Soon after the appearance of Stephani's monograph Howe³ published an account of the species occurring in California and found it necessary to reduce *A. nudata* to synonymy under *A. palmeri*. His treatment of the genus, which is remarkably full and clear, is accompanied by detailed illustrations of most of the Californian species and has been of great assistance to the writer in the preparation of the present report.

MORPHOLOGICAL NOTES ON THE GENUS.

The species of *Asterella* grow on earth, often among rocks, and sometimes form depressed mats of considerable extent. Although the genus has many tropical representatives, it extends as far south as Chile, Australia, and New Zealand, and as far north as Greenland, Alaska, Siberia, and Scandinavia. The European species, in fact, are characteristically alpine or arctic in their distribution, and most of them are found also in the northern parts of America and Asia. The genus includes both xerophytic and mesophytic species, some of the latter being at times almost hygrophytic in their appearance. Pigmentation with purple or red is a common phenomenon, although certain species usually show no signs of it. The pigmentation is especially well marked in xerophytic species, in which the thallus becomes involute upon drying, but it is often found almost as abundantly under more mesophytic conditions. The ventral surface is the first region to be affected, but pigmented dots or blotches

¹ Engl. & Prantl, Pflanzenfam. 1⁸: 33. 1893.

² Journ. Proc. Linn. Soc. Bot. 5: 126. 1861.

³ Mem. Torrey Club 7: 46-57. pl. 95-99. 1899.

often appear on the dorsal surface and a broad purple margin is sometimes a distinctive feature. The receptacles, both male and female, may also be subject to pigmentation.

Many of the structural features of *Asterella* were clearly described by Leitgeb¹ in 1881, in connection with his work on the more complex Marchantiales. He assigned the genus to his group Operculatae, partly on account of the method of dehiscence of the capsule, but partly also on account of the morphology of the female receptacle, as he conceived it. Campbell,² in 1895, showed that Leitgeb's interpretation of the receptacle would not apply to the Californian *Asterella californica* (Hampe) Underw., in which the female receptacle is of the type associated with the group Compositae, and it has since been shown that there are other species of *Asterella* and other genera of the Operculatae to which Leitgeb's interpretation will not apply. Although one of the latter author's most important distinctions between the Operculatae and the Compositae has thus been proved inconstant, the groups are still to be regarded as natural assemblages of genera, a fact which Cavers³ has recently emphasized.

Two types of branching are regularly found in *Asterella*, terminal branching by forking and intercalary branching by means of ventral outgrowths arising from the sides of the thickened median portion of the thallus. The terminal branches are broad from the beginning; the intercalary branches broaden out abruptly from a narrow stalk-like base. A supplementary type of branch, also intercalary in nature, is the apical innovation. This arises usually when the growth of a thallus is limited by the formation of an inflorescence, and the power of forming such branches does not appear to be at all general. As pointed out by Leitgeb, an abundant production of one type of branch is associated with a limited production of the other. Dichotomous branching, in fact, is characteristic of certain species, while ventral branching is characteristic of others. It is doubtful, however, if one type ever replaces the other altogether. In certain species the receptacles seem to be confined to ventral branches, which are usually limited in growth and are sometimes greatly abbreviated; in other species the receptacles are much less definite in position.

The thallus shows the usual differentiation into epidermis, green tissue with air spaces, and compact ventral tissue, the lower surface bearing scales and rhizoids of the two characteristic types. The epidermal cells exhibit considerable variety with regard to size and thickness of wall, but seem to be arranged invariably in a single layer. The variation in size is sometimes marked on an individual

¹ Unters. Leberm. 6: 84-87. pl. 4. 1881.

² Mosses and Ferns 57. f. 19. 1895.

³ New Phytol. Repr. 4: 34. 1911.

thallus, so that differences in size are not of much value in distinguishing the species. The thickness of the walls is also rather inconstant: in some cases the walls are distinctly and uniformly thickened; in others they are exceedingly thin. In fact, a great deal of variation in this respect is often found in a single species under different environmental conditions. Trigones, as a rule, are not present, but in certain species they form a more or less conspicuous feature of the epidermal cells. Scattered cells containing oil bodies occur in certain species and are sometimes distinguished from the other epidermal cells by their smaller size, as well as by their contents.

The epidermal pores on the vegetative thallus are of the simple type usual in the Operculatae. The opening is surrounded by a hyaline membrane representing the vestiges of a ring of disorganized cells, and around this are narrow and specialized cells arranged in radiating and concentric series. The pores vary in relative abundance, in size, and in number of specialized cells by which the openings are surrounded, and a great deal of variation is often to be found in a single species. In an average case each pore is surrounded by six radiating series of cells with three in each series, the outer cells being scarcely different from the ordinary epidermal cells. In some species the walls separating the radiating series of cells are more or less thickened, and this condition may be so marked that the pores acquire a stellate appearance, similar to what is found in most members of Leitgeb's *Astroporae*. Pores of this type, however, are very exceptional; it is much more usual for the radial walls to be only slightly thickened or even thin throughout. In most cases the pores project but slightly above the dorsal surface of the thallus.

The green tissue is built up on the *Reboulia* type¹ and incloses several layers of air chambers separated by partitions one cell thick. In some species the tissue is very loose, the air chambers being large; in other species the tissue is more or less compact. When the tissue is loose the dorsal chambers may not be subdivided at all, and each chamber under these conditions has its epidermal pore. This is the case, for example, in *A. tenella*, *A. ludwigii*, and *A. palmeri*. Even when the tissue is loose, however, the dorsal chambers may be somewhat subdivided by supplementary partitions, as in *A. lindenbergiana* and *A. californica*, and some of the chambers seem on this account to be destitute of pores. When the tissue is compact the subdivision of the dorsal chambers is carried much further, so that narrow and canal-like secondary chambers are formed, only a few of which show pores. *A. elegans* and *A. bolanderi* are good examples of this type. When a thallus is studied in cross section, the secondary partitions look as if they were free filaments and they have some-

¹ See Evans, Bull. Torrey Club 45: 235. 1918.

times been described and figured as such. It is doubtful, however, if actual filaments ever occur, even in the vicinity of the pores, although marginal cells of partitions may project as teeth. Cells containing oil bodies are scattered among the green cells, even when they do not occur in the epidermis.

The compact tissue forms a distinct keel in the median portion of the thallus and thins out more or less gradually on the sides, disappearing altogether at some distance from the margin. The keel formed is usually broad and rounded, but is narrow and sharp in *A. lindenbergiana*, where it constitutes one of the distinctive features of the species. The compact tissue is composed of uniform parenchyma, except for scattered cells with oil bodies. The walls are sometimes thin throughout, but are usually thickened to a greater or less extent and then show crowded and minute pits of the simple type. In certain species mycorrhiza is usually present, and it sometimes occupies a broad median strand, elliptical in section. The walls of the cells containing the mycorrhiza often, but not always, show a distinct purple pigmentation; otherwise the compact tissue is colorless or nearly so. In *A. californica* scattered slime cells may usually be observed, not only in the compact tissue but also in the partitions between air spaces. These cells vary greatly in abundance, and are sometimes absent altogether.

The ventral scales, as in most of the Marchantiales, are arranged in two longitudinal rows. As a rule the scales of one row alternate with those of the other, but this relationship is not always apparent. In specialized regions, such as the basal portion of a ventral branch or the terminal portion of a branch bearing a female receptacle, the arrangement tends to be irregular, and it is sometimes difficult to distinguish the two rows clearly. The scales often yield valuable characters in distinguishing species, but in considering them a certain amount of variability must be assumed and it is unwise to draw conclusions from too limited a number of examples. The scales are often exceedingly fragile, especially on plants developed in the shade or under moist conditions, and it is necessary to dissect them one by one from a mature thallus in order to secure an adequate idea of their form and structure. The division of the scales into basal portion and appendage or appendages is usually well marked, although the transition is sometimes very gradual. The basal portion is ovate to lunulate and is composed of cells distinctly smaller than those of the appendages. In most cases the marginal cells are considerably smaller and more irregular than those of the median portion. The margin itself is either entire or more or less denticulate, the teeth often representing the short and irregular stalks of slime papillae. Scattered about among the other cells are occasional cells containing

oil bodies, but rhizoid-initials are apparently not present. The appendages vary in number from one to four, when the genus as a whole is considered, and a good deal of variation is to be expected in most of the species. In certain cases, to be sure, a single appendage is the rule, but even here prolonged search will usually bring to light scales with two appendages. Sometimes, under these circumstances, one appendage is smaller than the other or appears in the form of a basal lobe. The appendages vary greatly also in size, in form, in the character of the margin, and in the apex, many of the variations being associated with environmental differences. In certain cases specific differences have been based upon these inconstant features. Stephani, for example, described the appendages of *A. wrightii* as being sometimes armed with a single large spine, and on the basis of this character placed the species in a group with dentate or lacerate appendages, instead of in the same group as *A. elegans*, of which it is actually a synonym. In this case the marginal teeth represent a somewhat unusual feature, possibly associated with a more xerophytic environment. He likewise assigns acuminate appendages to *A. tenella*, in which, as a matter of fact, rounded appendages are not infrequent.

The inflorescence in *Asterella* may be paroicous, autoicous, or dioicous. As a rule, each species shows a definite type of inflorescence, but certain autoicous species sometimes exhibit a tendency toward a dioicous condition. When the inflorescence is paroicous, as in *A. tenella*, the antheridia form a vaguely defined cluster close to the base of the stalk of the female receptacle. Such an androecium is very slightly elevated, the ostioles are low, and there is no surrounding fringe of narrow scales. In the autoicous species the androecium is more clearly defined. In some cases, as in *A. pringlei*, it forms an elongated and slightly elevated median patch which may be forked; the ostioles are more pronounced than in the paroicous species, and a scanty fringe of paleae may be present. Such an androecium apparently never limits the growth of the branch and makes its appearance at some distance behind the apex. In other cases, as in *A. elegans*, the androecium forms an oval or circular disk, distinctly elevated, and usually with a well-developed fringe of paleae. Such an androecium limits the growth of the branch and thus appears terminal in position. In *A. californica*, the only definitely dioicous species at present known in America, the androecium is of the elongated type, which does not limit the growth of the branch. So far as observed, the epidermal pores of the androecia are simple.

The female receptacle is borne on an elongated peduncle composed of compact parenchyma throughout and showing on its morphologically ventral side a single furrow with tuberculate rhizoids.

The peduncle is sometimes white or pale green but usually shows more or less purple pigmentation. In most species it bears scattered filamentous scales, these tending to be more numerous in the apical portion, but in certain species the scales are scanty or even absent altogether. The peduncle arises from the apex of a branch, the growth of which is almost invariably brought to an end. This branch is sometimes elongated and sometimes very short; in the latter case it is usually ventral in position, although in some instances one or both branches of a dichotomy may give rise to female receptacles almost immediately. Leitgeb mentions a single specimen of *A. ludwigii* (*Fimbriaria pilosa*) in which an abortive female receptacle failed to limit the growth of a branch, and makes the deduction that such limitation must therefore be a secondary, rather than a primary, result of the development of the receptacle and that the latter is dorsal in origin. No examples of this kind have come to the attention of the writer, but the remarkable conditions sometimes found in *A. californica* may be noted in this connection. In this species, as figures by Howe¹ clearly show, the receptacle may grow out from the bottom of a dichotomy, an ordinary branch appearing on each side. This would seem to indicate a dorsal origin, the apical region of the branch continuing its growth but undergoing a dichotomy at once. The subject, however, deserves further study.

The disk of the female receptacle, as already noted, has been the subject of considerable discussion. In the earliest developmental stages described by Leitgeb the archegonia, three or four in number, had already become displaced to the ventral surface through the active intercalary growth of the dorsal portion. They appear singly in low grooves, evenly distributed near the periphery, which at first shows no indication of lobing. Alternating with the archegonia are short furrows with rhizoids, continuous with the furrow of the peduncle. Since the archegonia occurred singly, Leitgeb concluded that the receptacle did not represent a branch system. Campbell found, however, that the archegonia of *A. californica* did not occur singly but in short radiating groups, those of each group arising in acropetal succession, and he concluded that in this species the receptacle must represent a branch system. According to the ideas of Goebel² such distinctions, which Leitgeb considered characteristic of the groups Operculatae and Compositae, are less important than has been supposed. In both cases the receptacle represents a branch; if the receptacles are similar in other respects, it is not of much significance whether this branch becomes subdivided or not.

¹ Mem. Torrey Club 7: pl. 95, f. 1-5. 1899.

² For a discussion of these ideas see Evans, Bull. Torrey Club 42: 271-274. 1915.

As development proceeds, the dorsal portion of the disk increases further in size and develops active photosynthetic tissue with air spaces in several layers. Those of the uppermost layer are bounded on the outside by an epidermis with pores of the compound or dolioform type. Sometimes the surface is fairly smooth, but in certain species the ceiling of each chamber projects in a vaultlike way, the surface thus becoming coarsely tuberculate. In *A. echinella* the projections reach an extreme development, attaining a height of a millimeter, and the surface acquires an almost spiny appearance. Sometimes the margin of the disk remains undivided, but more or less distinct lobes are usually developed, each lobe corresponding to an archegonium or group of archegonia. On the ventral surface two protective structures, in addition to the calyptra, make their appearance, although they remain abortive in the absence of fertilization. These structures are the involucre and the pseudoperianth.

The involucre, as Leitgeb noted, is not uniform throughout the genus. In the more usual cases it represents an outgrowth of the sides of the groove in which an archegonium (or group of archegonia) is situated and is then continuous with the edges of the lobes, forming a thin membranous expansion. This expansion, which never incloses the sporophyte on the outer side, is only one cell thick along the margin and is composed of colorless cells, among which scattered cells with oil bodies stand out conspicuously. When the margins of the lobes are strongly involute, the involucre is relatively narrow, as in *A. palmeri*, but this condition is exceptional, the involucre often attaining a width of 1 to 1.5 mm. Between the sporophyte and the peduncle the halves of the involucre become continuous, although there is sometimes a deep indentation in this region. When it is unusually deep, as in *A. californica*, the involucre appears to be divided into two parts. The involucre in such species as *A. africana* deviates somewhat from this account, as Leitgeb clearly shows. It represents a short membranous flap between the sporophyte and the peduncle, gradually narrowing out on the sides and reaching only part way to the margin. In all cases the margin of the involucre is either entire or vaguely and irregularly crenulate or denticulate.

The pseudoperianth is the most distinctive structure found in the genus and at once separates *Asterella* from all the other genera of the Operculatae. It consists of a tubular membranous sheath, narrowed at the apex to a small pore but more or less strongly inflated throughout the rest of its extent. When the sheath is young it is perfectly continuous, and this condition seems to be long maintained in the Persian *Fimbriaria silachorensis* Schiffn.,¹ a species allied to *A. ludwigii*. In most cases, however, the pseudoperianth becomes

¹ Oesterr. Bot. Zeitschr. 58: 229. pl. 7, f. 1. 1908.

longitudinally split at a comparatively early age, the splits beginning close to the apical pore and extending for a variable distance toward the base. In most cases the segments thus formed remain united at the apex, the wind sifting in between them and thus scattering the spores; but in a few species the segments become completely free with age. The number of segments varies usually from 8 to 16 but, more rarely, between wider limits. A good deal of variation, in fact, is sometimes encountered in a single species. With regard to color, also, the pseudoperianth varies. In certain species it is, apparently, always colorless; in others, such as *A. lindenbergiana*, it shows a deep purple pigmentation; in still others it may be colorless, or pigmented in varying degree. Although so distinctive for the genus as a whole, the characters derived from the pseudoperianth often have to be employed with considerable caution in distinguishing species.

If Goebel's ideas are to be accepted, the distinct discoid androecium found in certain autoicous species represents the most primitive type, because it approaches most closely the stalked androecia of *Marchantia* and *Preissia*. The median elongated androecia, with or without paleae, would then represent a more advanced type which has arisen through reduction, and the poorly defined androecia of the paroicous species would represent the most advanced condition found in the genus. A gradual loss of the power of limiting growth would be associated with this reduction. Of course here, as in other genera, the female receptacle is more conservative than the male, retaining its stalk even when the androecium has almost lost its individuality. It retains also its compound pores, which have come down to it from its more complex ancestors, while the androecia seem to have lost them altogether.

Similar deductions might be drawn from the related genus *Grimaldia*, although the conditions shown are less diverse. In *G. fragrans* (Balb.) Corda, for example, the androecium is much the same as in *A. elegans*, while in *G. dichotoma* Raddi it bears a strong resemblance to that of *A. pringlei*. Here again the epidermal pores are of the simple type. So far as the androecia are concerned, *Reboulia* occupies a somewhat intermediate position between the more complex genera and *Asterella*. The androecia are clearly defined, as in *A. elegans*, and often limit the growth of the branches bearing them, but they still show epidermal pores of the compound type; these pores, however, are composed of fewer tiers of cells than those of the female receptacle.¹

The sporophyte is of the type characteristic of the Operculatae. It consists of a bulbous foot, an exceedingly short stalk, and a rela-

¹ See Cavers, *Naturalist* 1904: 248. f. 4. 1904.

tively large capsule of a general globose form. The wall of the capsule is composed of a single layer of cells and is usually deep brown in color. The cell walls are more or less thickened and often show trigones; annular and spiral thickenings, however, are absent altogether. The upper part of the wall forms a more or less distinct circular lid, which falls off intact or in fragments, leaving behind a cup-shaped portion with an entire or irregularly dentate or lacerate margin.

The great importance of the spores in *Asterella* for taxonomic purposes has been emphasized by Howe.¹ It must be kept in mind, however, that the spores vary greatly in size, in color, and in surface markings, the differences often being due to varying conditions during critical stages of development. Spores, for example, which would be large, deeply pigmented, and coarsely reticulated under the best conditions, might be much smaller, paler, and almost smooth if the conditions had been bad. Taking the genus as a whole, the spores are of a fair size and show a distinct tetrahedral form, the base being represented by a spherical triangle; upon this base the surface markings usually attain their most typical development. The other three faces of the spore are plane triangles. On the six edges of the spore distinct membranous wings are present; these often vary considerably in width, even in a single species, and the wings bounding the spherical face are usually broader than the three wings formed at the junction lines of the plane faces. The outer wall layer, which of course yields the distinctive markings, is always more or less pigmented with yellow, brown, or purple, and sometimes becomes so nearly opaque that the markings are difficult to demonstrate. These markings are of two types: fine, irregular points or lines, representing local and often pigmented regions of thickening in the membrane; and coarser ridges, representing folds of the membrane. Sometimes the fine markings are the only ones present, and sometimes they anastomose to form a delicate and irregular reticulum. The coarser ridges in many cases unite to form a more regular reticulum, but they are often crowded together irregularly or unite vaguely and indiscriminately. The distinctive features of the spores will be considered in greater detail in connection with the individual species.

The pigmentation which is so characteristic of the spores usually affects the elaters also, although in a lesser degree. In most cases it is restricted to the spiral bands, but sometimes the rest of the wall is more or less colored, in rare cases to such an extent that the spirals are detected with difficulty. The number of spirals varies from one to three and is not always the same throughout the entire length of an elater. In *A. elegans*, for example, the middle portion usually

¹ Bull. Torrey Club 25: 191. 1898.

shows two spirals, while the ends show only one. Considerable variation in both length and diameter is to be expected.

SYSTEMATIC TREATMENT.

The subdivisions of the genus which have been proposed have not been very widely accepted. In the Synopsis Hepaticarum two subgenera of *Fimbriaria* are recognized. In the first, to which no special name is assigned, are placed the "species genuinae," characterized by a pseudoperianth which definitely surpasses the involucre; in the second, called *Brachyblepharis*, the pseudoperianth is said to be but little longer than the involucre, and the latter is described as being remote from the margin of the receptacle. The first subgenus is further divided into two sections, the first with pendent pseudoperianths, the second with horizontally spreading pseudoperianths.

Many years later Stephani¹ proposed a division into two groups (or sections), based on the structure of the thallus. In the first group, *Spongiosae*, the thallus is said to be comparable to that of *Ricciella*; in the second group, *Marchantioides*, it is said to have chlorophyllose filaments.

Schiffner² combined both classifications under the generic name *Hypenanthron*. To his first group, the equivalent of the first subgenus of the Synopsis, he gave the name *Euhypenanthron* and retained the name *Brachyblepharis* for the second. He regarded the groups as sectional in value, however, rather than as subgeneric. Under the first section he included Stephani's two groups.

In Stephani's monograph of 1899 these attempts at classification are ignored and a new classification, based primarily on the form of the female receptacle, is proposed. Four subdivisions are recognized. In the first the receptacles are described as disciform; in the second, as hemispherical in the center; in the third, as distinctly conical; in the fourth, as highly umbonate. Under each of these subdivisions (except the last) subordinate groups are recognized, based on differences in the appendages of the ventral scales.

Although many of the distinctions thus noted are often helpful in separating species, some of them at least are based on vague and inconstant characters, and the writer feels that they are hardly sufficient to characterize subgenera or even sections. This view seems to have been held by Howe, who made no attempt to divide the genus into subordinate groups, and Müller also, in his treatment of the European species, leaves the genus intact.

In the preparation of this paper the writer has had the privilege of examining the specimens in several herbaria and would express

¹ Hedwigia 31: 122. 1892.

² Engl. & Prantl. Pflanzenfam. 1³: 34. 1893.

his thanks to the various curators who have made this possible. In citing specimens under the individual species the following abbreviations are used: N. Y., for the herbarium of the New York Botanical Garden; H., for the herbarium of Harvard University; U. S., for the United States National Herbarium; C., for the herbarium of the Canadian Geological Survey; C. C. H., for the herbarium of Miss Caroline C. Haynes; and Y., for the herbarium of Yale University.

Duplicate types of the new species proposed have been deposited in the United States National Herbarium.

KEY TO THE SPECIES.

- a.* Dichotomous branching the usual type, ventral branching rare or lacking— *b.*
- a.* Dichotomous branching rare or lacking, ventral branching the usual type; dorsal air chambers subdivided by numerous supplementary partitions, the epidermal pores apparently fewer than the chambers— *f.*
- b.* Dorsal air chambers not subdivided by supplementary partitions; epidermal pores clearly as numerous as the dorsal chambers— *c.*
- b.* Dorsal air chambers more or less subdivided by supplementary partitions; epidermal pores apparently fewer than the chambers— *f.*
- c.* Cells with oil bodies present in the epidermis; cells immediately surrounding the epidermal pores with thin radial walls; inflorescence parolcous; segments of pseudoperianth becoming free with age; spores yellow, coarsely reticulate (at least on the spherical face)— *d.*
- c.* Cells with oil bodies lacking in the epidermis; cells immediately surrounding the epidermal pores with thickened radial walls; segments of pseudoperianth not becoming free with age; spores dark brown to nearly black, not coarsely reticulate— *e.*
- d.* Female receptacle distinctly lobed, smooth or nearly so; spores mostly 80 to 90 μ in diameter, the surface with fine lines in addition to the coarse reticulum— **1. *A. tenella* (p. 261).**
- d.* Female receptacle scarcely lobed, covered with low and coarse tubercles; spores mostly 60 to 65 μ in diameter, the surface punctulate.
2. *A. ludwigii* (p. 266).
- e.* Inflorescence autoicous; female receptacle hemispherical, with low and coarse tubercles and short but distinct lobes; pseudoperianths extending obliquely outward— **3. *A. pringlei* (p. 271).**
- e.* Inflorescence parolcous; female receptacle bluntly conical, smooth or nearly so, scarcely lobed; pseudoperianths extending almost vertically downward— **4. *A. palmeri* (p. 273).**
- f.* Xerophytic in habit, the margins of the thallus strongly incurved when dry— *g.*
- f.* Not xerophytic in habit, the margins of the thallus scarcely or not at all incurved when dry— *h.*
- g.* Appendages of the ventral scales 1 or 2, forming a conspicuous white cluster at the tip of the thallus; inflorescence monoicous; spores with wings and a fine surface reticulum, but without coarse ridges on the faces.
5. *A. saccata* (p. 276).
- g.* Appendages of the ventral scales (mostly) 2 to 4, not forming a conspicuous white cluster at the tip of the thallus; inflorescence dioicous; spores with coarse ridges on the faces, in addition to the wings and the fine surface reticulum— **6. *A. californica* (p. 280).**

- h. Pseudoperianth with purple segments----- 7. *A. lindenbergiana* (p. 283).
h. Pseudoperianth white or pale throughout----- i.
i. Thallus 1.5 to 4 mm. broad, the margins not closely undulate-crispate.
8. *A. venosa* (p. 286).
i. Thallus 8 to 10 mm. broad, the margins closely undulate-crispate.
9. *A. rugosa* (p. 289).
j. Not xerophytic, the margins scarcely or not at all incurved when dry---- k.
j. More or less xerophytic, the margins incurved when dry; sexual branches short; spores with coarse reticula on the faces, the meshes mostly 15 to 20 μ in diameter----- n.
k. Male branches variable in length; spores with coarse reticula on the faces, the meshes 8 to 20 μ in diameter----- l.
k. Male branches short; spores with fine and irregular reticula on the faces, the meshes mostly 2 to 8 μ in diameter----- 15. *A. versicolor* (p. 307).
l. Meshes on spore surface mostly 15 to 20 μ in diameter----- m.
l. Meshes on spore surface mostly 8 to 12 μ in diameter.
13. *A. reticulata* (p. 302).
m. Tubercles of female receptacle less than 0.5 mm. long.
10. *A. elegans* (p. 290).
m. Tubercles of female receptacle 0.5 to 1 mm. long.
11. *A. echinella* (p. 298).
n. Pseudoperianth mostly 8 to 10-cleft; reticula on spore surfaces rarely involving the marginal wings; elaters mostly 12 to 14 μ wide.
12. *A. lateralis* (p. 299).
n. Pseudoperianth mostly 10 to 16-cleft; reticula on spore surfaces usually involving the marginal wings; elaters mostly 8 to 12 μ wide.
14. *A. bolanderi* (p. 303).

1. *Asterella tenella* (L.) Beauv.

Marchantia tenella L. Sp. Pl. 1137. 1753.

Asterella tenella Beauv.; Lam. Dict. Sci. Nat. 3: 257. 1805 (?).

Fimbriaria tenella Nees, Hor. Phys Berol. 45. 1820.

Fimbriaria nigripes Bisch.; Lehm. Nov. Stirp. Pugill. 6: 19. 1834.

Fimbriaria tenella β *porphyrocephala* Bisch. Nov. Act. Acad. Caes. Leop. Carol. 17: 1023. pl. 69, f. II. 1835.

Fimbriaria tenella γ *brachypus* Gottsch., Lind. & Nees, Syn. Hep. 563. 1847.

Fimbriaria brachypus Mont. loc. cit., as synonym.

Fimbriaria mollis Tayl. Lond. Journ. Bot. 5: 411. 1846.

Hypenantron tenellum Trevis. Mem. Ist. Lombardo III. 4: 440. 1877.

Hypenantron molle Trevis. op. cit. 441. 1877.

Thallus bright green, often more or less pigmented with purple, especially on the ventral surface and along the margin, mostly 0.5 to 1.5 cm. long and 1.5 to 3 mm. wide, plane or somewhat concave, with undulate margins, branching regularly by forking, very rarely by ventral outgrowths, keel broad and rounded; epidermis composed of cells with slightly thickened walls, sometimes showing trigones, averaging about $40 \times 25 \mu$; pores slightly or not at all elevated, averaging (with their surrounding cells) about $40 \times 30 \mu$; surrounded by (4 to) 6 series of cells with 2 (or 3) cells in each series; cells containing oil bodies few and scattered, occurring in the epidermis, the green tissue, and the compact ventral tissue; green tissue loose, the air chambers in 4 or 5 layers (in the median portion), those of the dorsal layer larger than the others, not subdivided, each with an epidermal pore; compact tissue occupying about half the thickness of the thallus in the median portion, thinning out gradually on the sides and extending about halfway to the margin, composed of cells with more

or less thickened, pitted walls; mycorrhiza sometimes present in the ventral tissue; ventral scales ovate to lunulate, more or less pigmented, cells containing oil bodies mostly 10 or fewer, scattered, appendages 1 or 2, narrowly to broadly ovate, mostly 0.25 to 0.45 mm. long and 0.15 to 0.3 mm. wide, entire or more or less dentate on the margin, the teeth very irregular, the apex acute to rounded, the cells in median portion mostly 40 to 80×30 to 50μ , the marginal somewhat smaller; inflorescence parvicous, the antheridia forming a small indefinite group close to the peduncle of the female receptacle; ostioles low and inconspicuous; peduncle naked, often more or less pigmented with purple, 2 cm. long when well developed; disk of receptacle mostly 2 to 4 mm. across, the center hemispherical, smooth or nearly so but becoming rugose when dry, the lobes mostly four, short but distinct, extending obliquely downward, the margins and the deeply bifid involucre entire or irregularly sinuate or crenate; pseudoperianth mostly 8 to 12-cleft, hyaline or more or less pigmented with yellow or purple, the divisions finally free, ovate to lanceolate; capsule opening by a circular line of dehiscence above the middle, the operculum coming off in one piece; spores yellow, 70 to 110μ in diameter (mostly 80 to 90μ), with wavy wings 8 to 15μ wide along the edges, the entire surface covered with a system of numerous fine and irregular lines, sometimes anastomosing, the spherical face showing in addition a coarse and regular reticulum, the meshes mostly 16 to 18μ wide, inclosed by the marginal wing and a series of similar anastomosing ridges, each plane face usually with an irregular transverse ridge distinct from the wings; elaters yellow, straight or somewhat curved, mostly 140 to 200μ long (rarely 300μ) and 10 to 12μ wide, slightly tapering toward the blunt ends, the median portion with 2 (very rarely 3) spirals, one or both of the ends often with a single spiral for a variable distance.

The present species is widely distributed in eastern North America, its known range extending from Maine and Ontario to Georgia and Alabama, with a westward extension to Illinois, Missouri, and Texas. So far as the writer has been able to learn, all reports from localities outside this area have been based on incorrect determinations. The plants are largely, if not entirely, confined to the lowlands. They prefer relatively damp soil and may often be found in old fields, along roadside banks, or among rocks bordering streams. On account of their delicacy they are not well fitted for a xerophytic environment. In most cases the plants grow scattered or in small clusters but they sometimes form extensive mats, the numerous receptacles on their slender stalks giving them a distinctive and beautiful appearance under favorable conditions. There is little danger of confusing *A. tenella* with other members of the genus, since none of our species, with the possible exception of *A. echinella*, are known to encroach upon its range. When sterile, however, it has often been confused with *Reboulia hemisphaerica* and *Grimaldia fragrans*, to both of which it bears a certain resemblance. The following specimens have been examined:

ONTARIO: Windsor, 1892, *J. Macoun* 404 (N. Y.).

MAINE: Buckfield, 1877, *J. A. Allen* (Y.); Monmouth, *Merrill* 3 (N. Y., Y.); Kittery Point, *Thaxter* (H., Y.). First reported from Maine by the writer (*Rhodora* 5: 170. 1903), no localities being given.

NEW HAMPSHIRE: Cornish, 1904, *Haynes* 723b (Y.; listed by the writer in *Rhodora* 7: 58. 1905).

VERMONT: Jerico, *Evans* (Y.); Newfane, *Grout* (Y.); East Pownal, *Lorenz* 167 (N. Y.); Woodstock, *Kittridge* (N. Y.). Recorded by C. D. Howe (*Contr. Bot. Vermont* 3: 9. 1899); an earlier record of Frost seems to have been based on an incorrect determination.

MASSACHUSETTS: Amherst, 1871, *Jesup* (C.); Amesbury, *Huntington* (C. C. H., Y.); Wellesley, *Hallowell* (H.), *Cummings* (N. Y.); Bridgewater, *Crocker*

(N. Y.) ; Middlesex Falls, *Underwood* 2825 (N. Y.). First reported from Massachusetts by Tuckerman & Frost (Cat. Pl. Amherst Coll. 52. 1875), no localities being given.

RHODE ISLAND: Providence, *J. F. Collins* 1850 (C. C. H., Y.). First reported from Rhode Island by Bennett (Pl. Rhode Island 66. 1888), no localities being given.

CONNECTICUT: Hamden, 1868, *D. C. Eaton* (Y.) ; Redding, *Underwood* (N. Y.) ; Woodbridge, *F. W. Hall* (Y.) ; Orange, *Evans* (N. Y., Y.) ; Middletown, New Milford, Cheshire, Salisbury, and North Haven, *Evans* (Y.) ; East Haven, *J. A. Allen* (Y.) ; Andover, *Weatherby* (Y.) ; Bolton and Bethany, *Nichols* (Y.) ; Canterbury, *Hadley* ; Oxford, *Harger* (Y.) ; Weathersfield, *C. Wright* (H.). First reported from Connecticut by Eaton (Cat. Berzellus Soc. 68. 1878).

NEW YORK: Stiles, 1889, *Underwood* (N. Y.), *Fischer* (C., N. Y., U. S., Y.) ; distributed in *Underwood & Cook*, Hep. Amer., no. 44, as *Fimbriaria tenella* ; Crotona Park, New York City, *Sanial* (N. Y.) ; northern Washington County, *Mrs. R. C. Burnham* (Y.).

NEW JERSEY: Closter, 1861, *Austin* (C.) ; Hoboken, 1818, *J. Torrey* (?) (N. Y.) ; Bergen, *Austin* (N. Y.) ; Little Falls, *Underwood* (N. Y.) ; Bound Brook, *Stout* (N. Y.). First recorded from New Jersey by Torrey (Cat. Pl. N. Y. 84. 1819), the locality given being Bergen. Distributed, presumably from New Jersey material, by Austin, in Hep. Bor. Amer., no. 136, as *Fimbriaria tenella*.

PENNSYLVANIA: Reading, 1828, *T. G. Bischoff* (Lindenberg Herbarium, type of *Fimbriaria nigripes* Bisch. and *F. tenella* β *porphyrocephala* Bisch.) ; Philadelphia, *Lyon* (N. Y.; listed by Taylor, as *Fimbriaria mollis*, in Lond. Journ. Bot. 5: 411. 1844), *T. P. James* (N. Y.).

DELAWARE: Faulkland, 1886, *Commons* (N. Y., U. S.).

MARYLAND: Near Lanham, 1905, *Wheeler* (U. S.).

DISTRICT OF COLUMBIA: Washington and Rock Creek, 1889, *Coville* (U. S., Y.) ; beneath Chain Bridge near the Virginia side, *Rosen* (U. S.).

VIRGINIA: Alexandria, specimen from the James Herbarium (N. Y.) ; near Brandywine, *Ravenel* (Y.) ; Great Falls, *Mary F. Miller* 124 (C. C. H., U. S.). The type material of *Marchantia tenella* L. was collected in Virginia by J. Clayton.

NORTH CAROLINA: Hillsboro, *Curtis* (N. Y.) ; near Crowders Mountain, *H. A. Green* (U. S.). First reported from North Carolina by Curtis (Geol. & Nat. Hist. Surv. N. C. 3: 75. 1867), no localities being mentioned.

SOUTH CAROLINA: Chester, 1884, *H. A. Green* (C. C. H., U. S.) ; Summerville, *DuBois* (N. Y.).

GEORGIA: Toccoa Falls, 1891. *Underwood* 2559 (N. Y., U. S.) ; Rocky Face Mountain, Whitfield County, and between Lafayette and Pigeon Mountain, Walker County, *Harper* (N. Y., U. S.).

ALABAMA: Auburn, Lee County, 1897, *Earle & Baker* 20, 35, 47 (N. Y., U. S.).

MISSISSIPPI: Enterprise, 1897, *Tracy* 3084 (N. Y.).

OHIO: Waverly, 1889, *Herrick* (N. Y.). First reported from Ohio by Beardslee (Bot. Gaz. 1: 22. 1876), no localities being mentioned.

INDIANA: Owen County, 1893, *Underwood* (N. Y.).

ILLINOIS: Canton, 1880, *Wolf* (U. S.) ; Cobden, *Seymour* (N. Y.) ; near Williamsfield, *V. H. Chase* (Y.). First reported from Illinois by Wolf & Hall (Bull. Ill. State Lab. Nat. Hist. 1: 18. 1878).

TENNESSEE: Jackson, 1893, *Bain* 10 (N. Y.).

MISSOURI: Mine La Motte, *O. D. Allen* (Y.) ; Perryville, *Demetrio* 12 (N. Y., U. S.) ; Campbell, *Bush* 7 (N. Y.) ; Elmont, *Emig* 1007 (Y.).

ARKANSAS: Little Rock, *G. Engelmann* (N. Y.).

LOUISIANA: Sicily Island, specimen from the Hooker Herbarium (N. Y.; type of *Fimbriaria mollis*); Chateaugues, *Langlois* (C. C. H., U. S.); Mandeville, *Frère Celestin* (C. C. H., U. S.); without definite locality, *Short* (N. Y.).

TEXAS: Hunt County, *Saunders* (N. Y., Y.); College Station, 1914, *Blodgett* (N. Y., Y.); Austin, *McAllister* (N. Y., Y.).

First reports from Ontario, New York, Delaware, South Carolina, Georgia, Indiana, Tennessee, and Missouri were made apparently by Underwood (Bot. Gaz. 20: 60. 1895), no localities being mentioned in any case.

Asterella tenella was one of the first distinctively American liverworts to be described. Accompanying the description of Dillenius an older synonym of Clayton is quoted, as follows: "Lichen terrestris pileatus Clayt. n. 377. apud Gronov. Fl. Virg. p. 127." This quotation, however, deserves a word of explanation. In the first part of the first edition of the Flora Virginica, published in 1739, the work to which Dillenius refers, Gronovius does not list Clayton's plant as a distinct species but merely as a synonym of "*Hepatica vulgaris major, vel officinarum, Italiae. Mich. Pl. Gen. p. 3.*" Now Micheli's plant is clearly *Conocephalum conicum* (L.) Dum., and Dillenius recognized the fact that Clayton's plant was amply distinct, because he added to his citation the phrase, "Ubi recidendum synonymon Mich." It is of interest to note that Gronovius, in the second part of his Flora Virginica, published in 1743, follows the example of Dillenius and accepts Clayton's species, although he uses the Dillenian name. He adds the curious observation that the plant, mixed with black pepper, is recommended for use in case of mad dog bites. In a later edition of the Flora Virginica, published in 1762, Gronovius again lists the species, quoting the description from the Species Plantarum as authoritative, without adopting the binomial name which Linnaeus had proposed.

In the original description Dillenius gives as the English equivalent of his Latin polynomial, "The small channelled Liverwort, with fringed Caps." He calls attention to the forked branching of the thallus, to the abundance of the receptacles, and to the fringes at the margin of the disk, the color being described as whitish in the lower part and purple above. His figures show most of these features clearly and bring out in addition the long and slender stalks of the female receptacles. He cites the species from Virginia only, basing it entirely upon Clayton's specimens, and Linnaeus likewise restricts it to the same locality. The American origin of the species is thus adequately established. Before long, however, certain European writers confused *A. tenella* with various Old World species and assigned to it a very extensive geographical distribution. The confusion which thus arose will be considered more fully in connection with the following species. It came to an end in 1836, when Taylor¹ definitely restricted the name *Fimbriaria tenella* to plants from the United States, and since this date the species has rarely been reported from other localities.

The two synonyms, *Fimbriaria nigripes* and *F. mollis*, may now be considered. *F. nigripes* was based on specimens collected near Reading, Pennsylvania, in 1828, by T. G. Bischoff, an uncle of the author of the species. In the original description, which was written presumably by Lindenberg, the plant was compared with *F. tenella* and was said to differ in its terete, dark purple peduncles, in its larger umbonate receptacles, and in the inflexed purple segments of its pseudoperianth, the apices alone being white and hyaline. In *F. tenella* the peduncles were said to be striated and brown, the receptacle to be much smaller and not umbonate, and the segments of the pseudoperianth to be plane and white throughout. The year after the publication of *F. nigripes*, Bischoff himself reduced it to a variety *porphyrocephala* of *F. tenella*, and illustrated his

¹Trans. Linn. Soc. 17: 386. 1836.

account with a series of excellent figures. He still accepted the species in a broad sense, including under it various Old World material, and called attention to the great variability in color which the plants sometimes exhibited. He was also the first, apparently, to note that the elaters varied with respect to the number of spirals, one of the elaters figured being unispiral throughout, and another bispiral in the middle and at one end and unispiral at the other. Some of Bischoff's material in the Lindenberg Herbarium at Vienna has been examined by the writer and is clearly attributable to *A. tenella*.

Taylor's species, *F. mollis*, was based on two specimens. The first of these, which may be considered the type of the species, was collected at "Sicily Island, near New York," and came from the Hooker Herbarium; the second was collected near Philadelphia and came from G. I. Lyon's herbarium. The Sicily Island material is well represented in the Mitten Herbarium, but there is no island of that name in the vicinity of New York. There is, however, a place called Sicily Island in northeastern Louisiana, and it is probable that the specimens were collected there. This idea is supported by a second specimen in the Mitten Herbarium, collected in Louisiana, presumably by C. W. Short, and dated 1837. In all essential respects the two specimens are identical. According to Taylor's description, *F. mollis* is characterized by a pale green thallus; by purple scales with a single lanceolate tooth on each side; by a short twisted peduncle, brown below and yellowish green above; by a succulent hemispherical receptacle, soft and compressible; and by whitish or pale yellow, concave, obtuse segments on the pseudoperianth, with incurved margins. These features might easily come within the limits to be expected in a variable species, and some of them are due to immaturity, as the specimens in the Mitten Herbarium clearly show. The species, in fact, enjoyed but a short period of recognition. Although it was listed in the Synopsis in 1847, it was reduced to a synonym of *F. tenella* by Sullivant in 1856¹ and has since found no advocates.

A few other items dealing with the history of the species may be of interest. In 1803 Michaux² listed it from Canada, but this record must be considered doubtful on account of the rarity of the species within the Canadian boundaries. In 1819, Torrey³ recorded it from "Bergen;" fortunately this record is fully supported by a correctly named specimen, collected in 1818 on "hills at Hoboken" and preserved in the Torrey Herbarium, Hoboken being situated in Bergen County, New Jersey. In 1821 Schweinitz⁴ reported it from Pennsylvania and New York, but these records according to Nees von Esenbeck⁵ were based on specimens of *Grimaldia fragrans*. In the Synopsis Hepaticarum a variety γ *brachypus* is recognized, in addition to the typical form of the species and Bischoff's variety *porphyrocephala*. It was based on a manuscript species, *F. brachypus* Mont., collected in "Carolina." This variety, as the Synopsis admits, is distinguished by vague and unimportant characters, and there seems to be no good reason for recognizing it.

Stephani's account of *Asterella tenella* is full and accurate on the whole, although the ventral scales are far more variable than he implies. According to his description they are large and purple, with a large and hyaline, obliquely triangular, "acuminato, acuto" appendage, and on the basis of these features he places the species in a group with lanceolate appendages, thus separating it widely from some of its closest allies. As a matter of fact, the appendages

¹ In A. Gray, Man. ed. 2. 688. 1856.

² Fl. Bor. Amer. 2: 276. 1803.

³ Cat. Pl. N. Y. 84. 1819.

⁴ Spec. Fl. Amer. Crypt. 23. 1821.

⁵ Naturg. Eur. Leberm. 4: 225. 1838.

show a wide range of variation, especially with respect to the margin and apex. The margin, for example, may be quite entire or it may be more or less dentate, the teeth varying from vague crenations to distinct lobelike structures, 3 or 4 cells long and 2 or 3 cells wide at the base. With regard to the apex, the acute condition seems to be the most usual, but obtuse or even rounded apices may often be demonstrated. In spite of their fairly large size the ventral scales are very delicate; along their margins scattered and short-lived slime papillae may often be detected, even on the appendages, and the pigmentation sometimes extends from base to apex. The appendages, moreover, sometimes occur in pairs. Stephani's description of the spores as "grosse lobato-cristatae" hardly implies their reticulate surface markings, and his account of the pseudoperianth as "hyalina" seems to ignore the purple pigmentation which it often shows. These, however, are points of minor importance.

Since there are no other species of *Asterella* in eastern North America, it is usually easy to recognize *A. tenella* in the field, even when sterile. The plants in most cases are distinctly aromatic and this will help to separate the species from the more robust *Reboulia hemisphaerica*, while the delicate and inconspicuous scale appendages are very different from the large and prominent appendages of *Grimaldia fragrans*, which usually form a conspicuous cluster at the apex of the thallus. The outlines of the dorsal air chambers can usually be seen with the aid of a lens in the *Asterella* but not in the other two species; and the flat thallus, showing little tendency to become involute upon drying, is also distinctive.

2. *Asterella ludwigii* (Schwaegr.) Underw.

- Marchantia tenella* Retz. Fl. Scand. Prodr. ed. 2. 270. 1795, not L. 1753.
Marchantia polycephala Schleich. Cat. Pl. Helv. ed. 2. 31. 1807, nomen nudum.
Marchantia pilosa Wahl. Fl. Lapp. 399. 1812, not Hornem.
Marchantia ludwigii Schwaegr. Hist. Musc. Hep. Prodr. 33. 1814.
Marchantia gracilis F. Web. Hist. Musc. Hep. Prodr. 105. 1815.
Marchantia nana Schleich. Cat. Pl. Helv. ed. 4. 1821, nomen nudum.
Fimbriaria nana Lindenb. Nov. Act. Acad. Caes. Leop. Carol. 14: Suppl. 109. 1829.
Fimbriaria pilosa Tayl. Trans. Linn. Soc. 17: 386. pl. 13, f. 3. 1837.
Fimbriaria schleicheriana Corda; Nees, Naturg. Eur. Leberm. 4: 273. 1838, as synonym.
Dictyochiton pilulare Corda, op. cit. 280. 1838, as synonym.
Fimbriaria gracilis Lindb. Not. Sällsk. Faun. Fl. Fenn. Förh. 10: 282. 1868.
Asterella pilosa Trevis. Rend. Ist. Lombardo II. 7: 785. 1874.
Fimbriaria ludwigii Limpr.; Cohn, Krypt. Fl. Schles. 1: 340. 1876.
Hypenantron gracile Trevis. Mem. Ist. Lombardo III. 4: 440. 1877.
Hypenantron nanum Trevis. loc. cit.
Hypenantron pilosum Kuntze, Rev. Gen. Pl. 1: 89. 1891.
Asterella gracilis Underw. Bot. Gaz. 20: 61. 1895.
Asterella ludwigii Underw. loc. cit.
Fimbriaria macounii Stephani, Bull. Herb. Bolss. 7: 99. 1899.

Thallus green, often more or less pigmented with purple, especially on the ventral surface and along the margin, mostly 0.5 to 1.5 cm. long and 1 to 2 mm. wide, but often 3 to 5 mm. wide on broadened-out fertile plants, plane or somewhat concave, with thin undulate margins, sometimes more or less incurved when dry, branching regularly by forking, the keel broad and rounded; epidermis composed of cells with thin or slightly thickened walls, usually with more or less distinct trigones, averaging about $25 \times 20 \mu$; pores slightly elevated, averaging (with their surrounding cells) about $80 \times 65 \mu$, surrounded by

6 (rarely by 5, 7, or 8) series of cells with 2 (or rarely 3) cells in a series; cells containing oil bodies as in *A. tenella*; green tissue loose, the air chambers in 4 or 5 layers (in the median portion), those of the dorsal layer larger than the others, apparently never subdivided, each with an epidermal pore; compact tissue occupying from one-third to one-half the thickness of the thallus in the median portion, thinning out gradually on the sides and extending about halfway to the margin, composed of cells with slightly thickened, pitted walls; mycorrhiza not observed; ventral scales ovate to lunulate, deeply pigmented, sometimes vaguely crenulate or denticulate; cells containing oil bodies mostly 15 or fewer, scattered (rarely 2 side by side); appendages 1 or (rarely) 2, slightly or not at all constricted at base, lanceolate to ovate, rarely broadly ovate, mostly 0.2 to 0.6 mm. long and 0.15 to 0.3 mm. wide, entire or vaguely crenulate, the apex mostly acute to acuminate, rarely rounded, the cells in median portion mostly 50 to 80×25 to 40μ , the marginal ones somewhat smaller; inflorescence parvicous, the antheridia forming a small irregular group close to the peduncle of the female receptacle, the ostioles low and inconspicuous; peduncle naked or with a very few scattered paleae, more or less pigmented with purple, 3 cm. long when well developed; disk of receptacle about 2 mm. across, hemispherical, covered with low tubercles, the lobes mostly 3, scarcely evident, extending obliquely downward, the margins and the narrow involucre entire or nearly so; pseudoperianth mostly 8-cleft, hyaline, the divisions soon becoming free and irregularly spreading, narrowly lanceolate; capsule opening by a circular line of dehiscence above the middle, the operculum coming off in one piece; spores yellow, mostly 60 to 65 μ in diameter, with a wavy wing 6 to 10 μ wide along the edges, the entire surface minutely and sometimes indistinctly punctulate, the spherical face covered over with a coarse reticulum (sometimes irregularly or incompletely developed), the meshes mostly 9 to 12 μ wide, inclosed by the marginal wing and a system of anastomosing ridges of a similar character, each plane face sometimes with a similar reticulum and sometimes with a single transverse ridge connected with the wings; elaters yellow, variously curved and contorted, mostly 150 to 200 μ long and 8 to 10 (rarely up to 14) μ wide, distinctly tapering, the median portion with 2 or 3 spirals, the ends with 2 spirals.

The geographical distribution of this arctic and alpine species is extensive. In North America it is known from Greenland, the Rocky Mountains, and the Pacific Coast region; in Europe, from Finland and Scandinavia, from Iceland, from the mountains of eastern Germany, and from the Alps; in Asia, from Japan. The plants grow on earth among rocks and rarely occur abundantly. The following specimens from Europe and North America have been examined:

ALBERTA: Southeast end of Pabocton Pass, 1908, *Brown* 1086 (N. Y., Y.).

BRITISH COLUMBIA: Yale, 1875, *J. Macoun* (C., N. Y.); Eagle Pass, west of Revelstoke, *J. Macoun* (C., N. Y.); Mount Erskine, Salt Spring Island, Gulf of Georgia, *J. Macoun* (C., N. Y., U. S., Y.; listed, as *F. tenella*, by Pearson in List Canad. Hepat., 27. 1890; distributed under the same name by Macoun, Can. Hep., no. 73; listed, as *A. gracilis*, by Underwood in Bot. Gaz. 20: 62. 1895; type of *F. macounii* Steph.); Victoria and vicinity, *J. Macoun* (C. C. H., N. Y.; distributed, as *A. gracilis*, by Macoun, Can. Liv., no. 4); Agassiz, *J. Macoun* (C., N. Y.); Sproat, *J. Macoun* (N. Y.); Comox, Vancouver Island, *J. Macoun* (N. Y., U. S., Y.; distributed, as *F. pilosa*, in Can. Hep., no. 72); Hector, *J. Macoun* (same distribution); Goldstream, *J. Macoun* (C.); Kicking Horse Lake, *J. Macoun* (C., N. Y.); Chilliwack, *J. M. Macoun* (C., N. Y.). Many of these specimens are listed by Macoun in Cat. Can. Pl. 7: 4. 1902.

MONTANA: Long Baldy, Little Belt Mountains, 1896, *Flodman* 5 (N. Y., U. S.); Sperry Glacier, *Jones* 10690 (Y.).

COLORADO: Foothills 5 miles west of Fort Collins, 1896, *Baker* (U. S.); Boulder, *Bethel* 4 (Y.); near Tolland, *Young* (Y.). The second and third specimens have been listed by the writer, as *A. gracilis*, in *Bryologist* 18: 45. 1915.

UTAH: Headwaters of Little Cottonwood Creek, above Alta, 1905, *Rydberg* 6869a (N. Y.); Big Cottonwood Canyon, above Silver Lake Post Office, *Garrett* (N. Y., Y.).

WASHINGTON: Yakima region, 1882, *T. S. Brandege* (N. Y.; listed by Underwood, as *A. gracilis*, in *Bot. Gaz.* 20: 62. 1895); Tacoma, *Flett* (Y.); Mount Rainier, *Piper* 93 (N. Y.), *Flett* (Y.); Queets River Valley, Olympic Mountains, *Frye* 53 (Y.); bluffs near Cathlamet, *Foster* 513 (C. C. H., Y.; listed, as *A. gracilis*, by Miss Haynes in *Bryologist* 12: 65. 1909); Gate, Pierce County, *Foster* (C. C. H., N. Y., U. S., Y.; distributed by Miss Haynes in *Amer. Hep.*, no. 106, as *A. gracilis*).

OREGON: Snow line, Mount Adams, 1894, *Lloyd* (N. Y.).

CALIFORNIA: Near Mineral Spring, Tulare County, *Coville & Funston* 1420, 1510 (N. Y., U. S.; listed by Coville, as *F. bolanderi*, in *Contr. U. S. Nat. Herb.* 4: 230. 1893; also by Underwood, as *A. gracilis*, in *Bot. Gaz.* 20: 62. 1895).

FINLAND: Lojo, Skraddarla, 1878, *Lindberg* (C.).

SWEDEN: Gottsund, Upsala, *Myrin* (N. Y.); Jönköping, Småland, *Arnell* (C. C. H., Y.; distributed by Husnot, as *A. pilosa*, in *Hep. Gall.*, no. 170).

NORWAY: Dovres Kongswold, 1854, *Zetterstödt* (N. Y.); Tjöme, *Bryhn* (Y.); Opdal, Vangohen, *Hagen* (C. C. H.).

GERMANY: Near Charlottenbrunn, Weisseritztal, Silesia, 1860, *Milde* (N. Y., Y.; distributed by Gottsche & Rabenhorst, as *F. pilosa*, in *Hep. Eur.*, no. 161).

SWITZERLAND: Locality not stated, 1806, *Schleicher* (N. Y.; labeled *Marchantia polycephala*).

ITALY: Mont-Cenis, date and collector's name wanting (N. Y.); Valsesia, *Carestia* (N. Y.; distributed in *Erb. Critt. Ital.*, II., no. 956, as *F. pilosa*).

Among the species which certain writers have confused with *A. tenella* a prominent place is held by *A. ludwigii*. Apparently the first to fall into this error was the Danish botanist Zoëga,¹ who recorded *Marchantia tenella* somewhat doubtfully from Iceland. His example was soon followed by the Swedish botanist Retzius, who listed the species from Scandinavia, at first doubtfully² and then positively, as indicated in the synonymy. *M. tenella* was afterwards included in a number of floristic works by other early writers, especially in Sweden and Germany, but all these records, so far as known, were based on *A. ludwigii*.

Early in the nineteenth century Schleicher discovered the species in Switzerland and distributed specimens under the name *Marchantia polycephala*. Unfortunately he failed to establish this name by adequate publication. A few years later Wahlenberg found the plant in the parish of Folden in northern Norway. He recognized the fact that it was the same as the *M. tenella* of Zoëga and Retzius but he made the error of confusing it with *Marchantia pilosa* Hornem,³ now known as *Neesiella pilosa* (Hornem.) Schffn. Of course this makes the name *M. pilosa* Wahl. a mere homonym of *M. pilosa* Hornem. and therefore without nomenclatorial standing; but certain later writers have attempted to maintain the validity of both names, citing the present species as *Asterella pilosa* (Wahl.) Trevis. or *Fimbriaria pilosa* (Wahl.) Tayl.

¹ In Olafsen & Povelens, *Reise igiennem Island*, Tilhang 14. 1772.

² *Fl. Scand. Prodr.* 222. 1779.

³ *Fl. Dan. pl.* 1426. 1810.

Soon after Wahlenberg's account of the plant, under the incorrect name *M. pilosa*, had been published, *M. ludwigii* Schwaegr. and *M. gracilis* F. Web. were proposed as new. *M. ludwigii* was cited from Germany and doubtfully from Switzerland; later publications show that the type specimens were collected by Ludwig in the Sudetic Mountains of Silesia, no more definite locality being given. *M. gracilis* was based on material collected by Wahlenberg in the vicinity of Upsala, Sweden. The latter species has long been recognized as a synonym of *M. pilosa* Wahl., but the status of *M. ludwigii* has been doubted. Nees von Esenbeck,¹ for example, in citing it as a possible synonym, suspected that it might really represent *Grimaldia fragrans*. Gottsche implies that this doubt was unfounded. In the critical remarks which he appends to Rabenhorst's Hep. Eur. no. 161, where material collected in Silesia by J. Milde is distributed, he alludes to Ludwig's specimens and to Nees von Esenbeck's remarks, and speaks of Milde's *rediscovery* of the species. Limpricht is even more definite, citing *M. ludwigii* as a synonym and following the citation with an exclamation point. Since, however, he recognizes the validity of *M. pilosa* Wahl., at least provisionally, he retains the name *Fimbriaria pilosa* for the species and merely proposes *F. ludwigii* as an alternative name, in case *F. pilosa* should ever be given up. As shown above, *Marchantia pilosa* Wahl. is untenable and therefore the names *Fimbriaria pilosa* and *Asterella pilosa* can not be maintained. The combination *Asterella ludwigii*, first tentatively proposed by Underwood, is therefore advocated.

When Nees von Esenbeck proposed the genus *Fimbriaria*, he cited his fourth species, *F. tenella*, from Virginia and Canada only. *Marchantia gracilis*, *M. ludwigii*, and *M. pilosa* he gave as possible members of the genus, but did not definitely include them on account of the fact that the divisions of their perianths become free. A few years later² he included *M. gracilis* and *M. ludwigii* among the synonyms of *F. tenella* and cited the species from Sweden, Germany, Switzerland, and Java, as well as from Virginia. He therefore fell into the old error of Zoëga and Retzius, which Wahlenberg, Schwaegrichen, and Weber had escaped. This error was repeated by Lindenberg,³ by Hübener,⁴ and by Bischoff,⁵ who understood *F. tenella* in the same broad sense. When Taylor definitely restricted the name *F. tenella* to North American plants and gave the name *F. pilosa* to the European plant, Nees von Esenbeck accepted his distinctions. At first, however, he continued to cite the Javan specimens under *F. pilosa*. In the Synopsis Hepaticarum he made these Javan specimens the type of a new species, *F. blumeana* Nees, and included under *F. pilosa* a long series of European specimens and also a specimen from Greenland, collected by Vahl, this being the first record for North America.

Lindenberg's *Fimbriaria nana* was based on Swiss material collected by Schleicher and distributed as *Marchantia nana*. Without having seen specimens, Nees von Esenbeck accepted the species in his Naturgeschichte, but stated that it might perhaps be nothing more than a form of *F. pilosa*. It is retained also in the Synopsis Hepaticarum, where no doubt is thrown on its validity. Later writers on Swiss Hepaticae rarely mention *F. nana*, although it is accepted as a species by both Dumortier⁶ and Sydow.⁷ In 1899 Stephani included

¹ Naturg. Eur. Leberm. 4: 273. 1838.

² Nov. Act. Acad. Caes. Leop. Carol. 12: 411. 1825.

³ Nov. Act. Acad. Caes. Leop. Carol. 14: Suppl. 109. 1829.

⁴ Hep. Germ. 6. 1834.

⁵ Nov. Act. Acad. Caes. Leop. Carol. 17: 1022. 1835.

⁶ Hep. Eur. 158. 1874.

⁷ Leberm. Deutschl. Oesterr. Schweiz 79. 1882.

it as a doubtful synonym under *F. pilosa*, and Müller¹ has since reduced it definitely to synonymy. The characters which Lindenberg assigned to it might easily come within the range of variability to be expected in a species of *Asterella*.

The known range of *A. ludwigii* in North America has been gradually extended since the time of Nees von Esenbeck. In 1875 Berggren cited several new stations for Greenland, and other stations have since been added by Lange, C. Jensen, and Stephani. In 1884 Underwood recorded the species from British Columbia, in 1891 from Washington, and in 1895 from California. In 1915 the writer listed two stations from Colorado, and stations from Montana, Utah, and Oregon are reported in the present paper. The stations in British Columbia were given in detail by Pearson in 1890 and by Macoun in 1902. One specimen, which was cited by Underwood in 1895 under *Asterella gracilis*, has been the cause of considerable confusion. It was collected by Macoun on Salt Spring Island in the Gulf of Georgia and is listed by Pearson under the name *Fimbriaria tenella*, the station being given as Vancouver Island. By Stephani this specimen was made the type of a new species, *F. macounii*. According to his description the appendages of the ventral scales are oblong or ovate and rounded at the apex, while in *F. pilosa* (as he calls it) the appendages are said to be lanceolate and sharp-pointed. These differences are, unfortunately, inconstant, and the other differential characters brought out in the description are equally subject to variation. The writer therefore has no hesitation in reducing *F. macounii* to synonymy.

Although the ranges of *A. tenella* and *A. ludwigii* do not overlap, and although one is an inhabitant of temperate lowlands while the other prefers arctic regions and mountains, the two species have many features in common, and it is not surprising that they have given rise to much confusion. They are both of about the same size; they branch regularly by forking; they show a loose green tissue, the dorsal air chambers being undivided and each having an epidermal pore; the appendages of their ventral scales are similar in both form and size; their inflorescence is paroicous; the peduncles of their female receptacles are nearly or quite destitute of paleae; their disks are hemispherical; their pseudoperianths are normally 8-cleft, the divisions separating sooner or later; and they both have yellow spores, distinctly reticulated on the spherical face. These resemblances show a close relationship between the species. In separating them certain characters derived from the ventral scales, the female receptacles, the divisions of the pseudoperianths, the spores, and the elaters can usually be relied on. In *A. tenella* the appendages of the scales, if enough are examined, show examples with distinct marginal teeth; the female receptacles have a smooth or almost smooth surface and distinct though short lobes; the divisions of the pseudoperianth often show a purple pigmentation and tend to be ovate; the spores are mostly 80 to 90 μ in diameter, the surface is marked with fine lines, and the plane faces show short ridges not extending all the way across; the elaters, finally, often show a single spiral at one or both ends. In *A. ludwigii*, on the contrary, the appendages either are entire or show vague crenulations only; the female receptacles are covered over with low tubercles and their lobes are scarcely apparent; the divisions of the pseudoperianth are uniformly white and lanceolate; the spores are mostly 60 to 65 μ in diameter, the surface is punctulate, and the plane faces are sometimes reticulated and always show ridges extending all the way across; the elaters, finally, show (apparently always) 2 spirals at each end. Perhaps on account of its inclement habitat, the plants of *A. lud-*

¹ Rabenh. Krypt. Fl. 6: 273. 1907.

wigii tend to show a less luxuriant development than those of *A. tenella*, and the thallus often appears simple on account of the death of the older parts.

3. *Asterella pringlei* Underw.

Asterella pringlei Underw. Bot. Gaz. 20: 64. 1895.

Fimbriaria pringlei Stephani, Bull. Herb. Boiss. 7: 96. 1899, not Stephani, Rev. Bryol. 36: 139. 1909.

Thallus sometimes green throughout, becoming brownish or purplish with age, but usually somewhat pigmented with purple even when young, especially on the ventral surface, mostly 1 to 1.5 cm. long and 3 to 5 mm. wide, plane or slightly concave, with thin, undulate, more or less crispate and crenate margins, branching most frequently by forking, more rarely by apical innovations, apparently never by ventral outgrowths, the keel broad and rounded; epidermis composed of thin-walled cells without trigones, averaging about $40 \times 25 \mu$; pores somewhat elevated, mostly isodiametric (at least in the median portion), measuring (with their surrounding cells) 40 to 60 μ in diameter, surrounded by 4 to 6 series of cells, with 2 cells in each series, the cells next the opening with more or less thickened radial walls; cells with oil bodies not observed in the epidermis, otherwise as in *A. tenella*; green tissue compact below, looser above, the air chambers in 4 or 5 layers, those of the dorsal layer larger and higher than the others, not subdivided, each with an epidermal pore; compact tissue occupying about three-fifths the thickness of the thallus in the median portion, thinning out gradually or abruptly on the sides and extending from one-half to two-thirds the distance to the margin, composed of cells with thin unpitted walls; mycorrhiza not observed; ventral scales contiguous, not reaching the margin, usually more or less pigmented with purple, ovate, the cells containing oil bodies mostly 1 to 3; appendages borne singly or rarely in pairs, broadly subulate and not constricted at the base, often hyaline, mostly 0.7 to 1 mm. long and 0.15 to 0.45 mm. wide at the base, the margin entire or irregularly spinose-dentate, the teeth mostly 1 to 5, 1 to 6 cells long and 1 or 2 cells wide at the base, each tooth as well as the acute to short-acuminate apex tipped with a more or less persistent slime papilla, sessile papillae of a similar nature often present also, the cells throughout appendage mostly $40 \times 30 \mu$; inflorescence autolcous; male inflorescence consisting of a long and narrow median cluster of antheridia, not surrounded by paleae, borne on an ordinary branch and not limiting its growth, the ostioles long and slender; peduncle naked, arising from the apex of a more or less elongated branch, yellow to brown, not pigmented with purple, mostly 1 to 1.5 cm. long; disk of receptacle mostly 3 to 4 mm. across, green to purple, hemispherical, covered with low and coarse rounded tubercles, the lobes mostly 4, short but distinct, extending obliquely downward, the margins and the involucre entire or nearly so; pseudoperianth mostly 12 to 16-cleft, white or pale, the divisions lanceolate, coherent at the apex; capsule circumscissile above the middle by a jagged line, the small operculum coming off in one piece; spores dark brown, sometimes almost opaque, mostly 80 to 120 μ in diameter, with a wing 6 to 8 μ wide along the edges, the entire surface covered with a system of fine and irregular darker ridges 1 to 2 μ high, on a paler background, the ridges sometimes anastomosing and forming an irregular network with meshes 2 to 4 μ across and sometimes not, the surface sometimes showing in addition a system of low and broader folds about 4 μ high and more or less anastomosing but never forming a network, the periphery of spores appearing coarsely or finely crenulate; elaters brown, more or less curved, mostly 200 to 220 μ long and 12 to 16 μ in diameter, tapering slightly toward the rounded ends,

sometimes with a single spiral throughout but usually with 2 spirals in the median portion for a variable distance.

Known only from central Mexico; inhabiting damp banks and rocks. The following specimens have been examined:

JALISCO: Near Guadalajara, 1890, *Pringle* (N. Y., type); Barranca de Oblatos, Guadalajara, *Barnes & Land* 121 (Y.).

VERACRUZ: Near Orizaba, *Barnes & Land* 671 (Y.).

This interesting and distinct species is still known from very few localities, so few in fact that its range of variability may be greater than the description implies. The type material in the Underwood Herbarium represents a somewhat more lax and delicate form than the specimens collected by Barnes and Land, but the plants agree closely in their more essential features and there is little doubt regarding their identity. Underwood's original description calls attention to the general aspect of the thallus, to the most important characteristics of the female receptacle and its peduncle, to the white pseudoperianths with their coherent segments, and to the dark spores covered over with narrow reticulations. He assigns to the spores, however, a diameter of 118 to 135 μ , which is a trifle high, and states that the elaters have 2 or 3 spirals, making no allusion to the fact that they are unispiral at each end and sometimes throughout their entire extent. He makes no mention, moreover, of the various tissues composing the thallus or of the male inflorescence, and his account of the ventral scales as "slender whitish [and] lanceolate" omits mention of the curious teeth which their appendages often show.

Stephani's description is somewhat more explicit and supplies some of the deficiencies in the original account. He notes the monoicous inflorescence; the occurrence of the antheridia on leading branches; the small epidermal pores, each surrounded by 6 radiating series of cells with 2 cells in each series; and the large hyaline appendages of the ventral scales, sometimes armed with a spine. At the same time a few of his statements are open to criticism. He describes the branching, for example, as being usually by apical innovations, and adds that the female branches always arise from the side of costa. According to the writer's observation, apical innovations are rare and the female inflorescence is borne on a leading branch produced by forking, agreeing in this respect with the male inflorescence. Stephani's description of the spores as "grosse tuberculatae" is also misleading.

The ventral scales present several features of interest. The basal portion is normally pigmented with purple, but often shows a broad hyaline border. Its cells decrease slightly in size toward the margin, but do not show the marked increase in irregularity which is usual in the genus; and the slime papillae are short-lived and inconspicuous. The small number of cells containing oil bodies is also noteworthy. The appendages are remarkable for their large size and wide range of variability. At their junction with the basal portion they are scarcely constricted, as Stephani notes, and from this rather broad base they taper gradually to the sharp-pointed apex. On their sides they may be quite entire, but it is not unusual for teeth, irregular in number and in size, to be present, and the persistent slime papillae, tipping the teeth or borne directly on the margin, represent an unusual peculiarity and stand in marked contrast to the short-lived papillae of the basal portion.

The markings of the spore are likewise subject to great variation. As noted in the description, these markings are of two types, the fine lines and the coarser folds; and the marked development of one type seems to decrease or prevent the development of the other. The type specimens, for example, show the folds with especial clearness; these are more or less elongated and show a somewhat sinuous course, sometimes being free, and sometimes anastomosing

sparingly, but never forming an actual reticulum; the fine markings, on the contrary, are made out with difficulty, although a careful search will usually demonstrate their presence in some part of the wall. In the specimens collected by Barnes and Land (nos. 121 and 671) these conditions are almost reversed; the fine lines here are everywhere distinct and sometimes form an irregular reticulum, but the folds are difficult to see, although the distinct crenulations at the periphery show that such folds must be present. It was thought at first, from a study of these two diverse spore types, that two species might be represented, but the close agreement between the specimens in other respects seems to preclude this idea.

Although *A. pringlei* shares certain characteristics with *A. tenella* and *A. ludwigii*, it would hardly be possible to confuse them. The three species agree in general habit, in their method of branching (which is normally by forking), and in their undivided dorsal air chambers, each opening by an epidermal pore. *A. pringlei*, however, in spite of growing in damp localities, shows a certain tendency toward xerophytism in having these dorsal chambers high and narrow, the more deeply situated chambers being very small. The green tissue thus stands in rather sharp contrast to the much looser tissue of the other two species, where the chambers are larger and approximately isodiametric. The species is further distinguished by the thickened radial walls of the cells encircling the pore, by the lack of cells containing oil bodies in the epidermis, by the thin unpitted walls of the compact tissue, by the autoicous inflorescence, and by the dark and almost opaque spores without a coarse reticulum. In both *A. tenella* and *A. ludwigii* the cells encircling the pore have thin radial walls, cells containing oil bodies are present in the epidermis, the cells of the compact layer usually show pitted walls, the inflorescence is paroicous, and the spores are yellow or pale brown, translucent, and covered over (at least on the spherical face) with a coarse reticulum. The remarkable appendages of the ventral scales bear a certain resemblance to those of *A. tenella*, especially when teeth are present, but these appendages are larger and more uniformly sharp-pointed, and their teeth are usually more spinelike in appearance. The slime papillae on the appendages are also a distinctive feature, no such papillae being present on the mature appendages of *A. tenella*.

4. *Asterella palmeri* (Austin) Underw.

Fimbriaria palmeri Austin, Bull. Torrey Club 6: 47. 1875.

Fimbriaria nudata Howe, Erythea 1: 112. 1893.

Asterella nudata Underw. Bot. Gaz. 20: 61. 1895.

Asterella palmeri Underw. op. cit. 63. 1895.

Thallus green but more or less pigmented with purple on the ventral surface and along the margin, mostly 0.5 to 1 cm. long and 2 to 4 mm. wide, broadened out on fertile plants, more or less concave, especially when dry, the undulate and crispate margins becoming strongly incurved and somewhat scarious, branching by forking, the keel broad and rounded; epidermis composed of thin-walled cells without trigones, averaging about $35 \times 25 \mu$; pores more or less elevated, measuring (with their surrounding cells) 75 to 90 μ in length and 60 to 70 μ in width, surrounded by 6 (sometimes 4, 5, or 7) series of cells with 2 cells in each series, the cells next the opening with more or less thickened radial walls; cells with oil bodies not observed in the epidermis, otherwise as in *A. tenella*; green tissue rather compact, the air chambers in 3 or 4 layers (in the median portion), those of the dorsal layer elongated vertically and much higher than the others, not subdivided, each with an epidermal pore; compact

tissue occupying from one-half to one-third the thickness of the thallus in the median portion, thinning out rather abruptly on the sides and extending about one-third the distance to the margin, composed of cells with thin unpitted walls, mycorrhiza sometimes present; ventral scales imbricated, extending to the margin or beyond, deeply pigmented throughout or with hyaline appendages, the cells containing oil bodies 10 or fewer, scattered, sometimes difficult to demonstrate, the appendages usually borne singly, sometimes in pairs, broadly to narrowly subulate, scarcely or not at all constricted at the base, mostly 0.5 to 0.9 mm. long and 0.1 to 0.25 mm. wide, entire or sparingly dentate on the margin, the teeth usually parallel with the appendage and 2 or 3 cells long, the cells variable in size in different appendages, less so in different parts of the same appendage, mostly 35 to 90 μ long and 25 to 30 μ wide; inflorescence parvicous, the antheridia forming a small irregular group close to the peduncle of the female receptacle, the ostioles low; peduncle naked, arising from the apex of a more or less elongated branch or from the bottom of a dichotomy, somewhat pigmented with brownish in the lower part, mostly 1 to 2 cm. long; disk of receptacle about 4 mm. high and 2.5 to 4 mm. wide, obtusely conical, smooth or nearly so when fresh, rugose when dry, scarcely lobed, the margins and the very narrow involucre entire or nearly so; pseudoperianths mostly 3 or 4 (rarely 2, 5, or 6), extending vertically downward, white, sometimes constricted at the base, 8 to 12-cleft, the segments adherent at the apex; capsule opening by an irregular circular line above the middle, the operculum coming off in one piece; spores dark brown to almost black, often opaque, 60 to 80 μ in diameter, with a low wavy fold or wing about 5 μ wide along the edges and similar folds on the faces of the spore, otherwise smooth or obscurely punctulate, the surface folds variable in length (sometimes reduced to tubercles), crowded and variously interwoven but not forming a distinct reticulum, the spore surface often appearing convolute, the periphery of spore coarsely crenate with about 25 crenations in all; elaters pale to dark brown, variously curved, mostly 140 to 180 μ long and 12 to 14 μ in diameter, scarcely tapering toward the rounded ends, sometimes with a single spiral throughout but usually with 2 (rarely 3) spirals in the median portion for a variable distance and one at each end.

Originally described from specimens collected on Guadalupe Island, off the coast of Lower California; now known also from California and from the mainland of Lower California. The following specimens have been examined:

CALIFORNIA: Mill. Valley, Marin County, *Howe* (N. Y.; type of *Fimbriaria nudata*); Jackson, Amador County, *Hansen* (N. Y.); Middle Fork, Amador County, *Hansen* (U. S.); St. Helena, Napa County, 1893, *Jepson* (N. Y., U. S., Y.); Santa Ana Hills, 1884, and Glover Mountain, near San Bernardino, *Parish* 1704, 2744 in part (N. Y.); Santa Monica, *Hasse* (N. Y.); Pasadena and vicinity, *McClatchie* (N. Y.), *Kingman* 702 (C. C. H.), *C. W. Harris* 1 (C. C. H.); Altadena, *Kingman* 1205 (N. Y., C. C. H.); Witch Creek, *Alderson* 908 (N. Y.); San Luis Obispo, *Mrs. R. W. Summers* (U. S.); San Diego, collector's name wanting (N. Y.). Several of these specimens have been listed by *Howe* (Mem. Torrey Club 7: 56. 1899).

LOWER CALIFORNIA: Carrizo Creek, *T. S. Brandege* (N. Y., C. C. H.); Guadalupe Island, 1875, *Palmer* 119 (N. Y.; type of *Fimbriaria palmeri*), *Rose* 16012 (N. Y.).

Austin, with his usual keenness, emphasizes several of the most striking characteristics of this well-marked species in his original description. He calls attention, for example, to the strongly thickened median portion of the thallus and to the broad margins; to the papulose-areolate appearance of the upper surface; to the blackish purple scales, extending beyond the margin; to the

oblong-conical or ovate-conical receptacle, borne on a naked peduncle; to the white pseudoperianth, with segments coherent at the apex; and to the brown spores, indistinctly granulose-papillose. In stating that the female receptacle is 5-fruited, however, he makes no allowance for variation, and he fails to make enough allowance when he describes the segments of the pseudoperianth as 8 to 10 in number.

When Howe proposed his *Fimbriaria nudata* as a new species he recognized its close relationship to *F. palmeri* but felt justified in separating it, largely because it usually had a 3 or 4-fruited receptacle and a pseudoperianth with 10 or 11 divisions. Both Underwood and Stephani considered Howe's species valid, but Howe himself, after studying authentic material of *F. palmeri*, decided that Austin's species and his own were synonyms, a decision with which the writer fully agrees. Howe's description and figures of *Asterella palmeri*¹ show most of the important features with great clearness. He mentions, among other details not noted by Austin, the group of antheridia close to the peduncle of the female receptacle, the nearly smooth surface of the receptacle, the circumscissile capsule, and the measurements of the spores and elaters. Stephani supplies a few additional data about the epidermal pores and ventral scales and alludes especially to the high and narrow air chambers of the dorsal layer. In the case of *F. nudata* he compares the structure of the green tissue with that of *Riccia*, associating it with a dry climate which prevents the development of a flat and thin thallus.

On the whole the xerophytism of *A. palmeri* is much more distinct than that of *A. pringlei*. It shows itself not only in the narrow air chambers of the green tissue but also in the strong involution of the thallus when dry and in the relatively larger ventral scales. When teeth are present on the appendages, the scales bear a certain resemblance to those of *A. pringlei*, the teeth in both species representing the stalks of slime papillae. But the papillae are very ephemeral in *A. palmeri* and the teeth tend to be fewer and shorter than in *A. pringlei*, in many cases being absent altogether. The teeth usually diverge but slightly and are sometimes detected with difficulty.

The tendency of the spores to cling together in masses until late in the development of the capsule is alluded to by Howe. Usually under such circumstances the spores are somewhat arrested in their growth and fail to show the markings in a typical manner. When well developed the ridges of the spore surface are very distinctive, being low and rounded, instead of high and sharp as in most species of *Asterella* where equally coarse markings are present. The folds are very irregular and often anastomose, sometimes inclosing small areas, but the surface never shows a distinct reticulum, even when these inclosed areas are numerous; it is much more likely to be convolute in appearance. The wings along the edges of the spore are scarcely different from the folds.

Aside from the differences already mentioned, *A. palmeri* differs from *A. pringlei* in its parolcous inflorescence, agreeing in this respect with both *A. tenella* and *A. ludwigii*. Its more xerophytic structure will at once distinguish it from both these species, where the green tissue is very loose and the thallus shows little tendency to become involute when dry. It is further distinguished by the thickened radial walls in the circle of cells around the epidermal pores, by the conical female receptacle, by the pseudoperianths extending vertically downward, by the coherent segments of the pseudoperianths, and by the much darker spores, the spherical faces of which are not covered over by a coarse reticulum.

¹ Mem. Torrey Club 7: 55. pl. 99, f. 1-15. 1899.

5. *Asterella saccata* (Wahl.) Evans.

Marchantia fragrans Schleich. Pl. Crypt. Exsic. Helvet. 3: 64. 1804, nomen nudum; Lam. & DC. Fl. Franç. ed. 3. 2: 423. 1805, not Balb.

Marchantia saccata Wahl. Ges. Naturf. Freund. Berlin Mag. 5: 296. pl. 7, f. 3. 1811.

Fimbriaria saccata Nees, Hor. Phys. Berol. 45. 1820.

Fimbriaria fragrans Nees, loc. cit.

Hypenanthron ciliatum Corda; Opiz, Beitr. Naturg. 648. 1828, nomen nudum.

Marchantia umbonata Wallr. Linnaea 14: 686. 1840.

Fimbriaria umbonata Wallr.; Gottsch., Lind. & Nees, Syn. Hep. 559. 1846.

Asterella fragrans Trevis. Rend. Ist. Lombardo II. 7: 785. 1874.

Hypenanthron fragrans Trevis. Mem. Ist. Lombardo III. 4: 440. 1877.

Hypenanthron umbonatum Trevis. loc. cit.

Hypenanthron saccatum Trevis. loc. cit.

Thallus green but more or less pigmented with purple on the ventral surface and along the margin, mostly 0.5 to 1 cm. long and 2 to 3 mm. wide, plane or somewhat concave when moist, the undulate margins strongly incurved when dry, branching by forking, the keel broadly rounded to bluntly carinate; epidermis composed of cells with more or less thickened walls and distinct trigones, averaging about $30 \times 20 \mu$; pores more or less elevated, measuring (with their surrounding cells) mostly 70 to 140 μ in length and 50 to 70 μ in width surrounded by 6 (sometimes 5 or 7) series of cells with 2 or 3 cells in each series, the radial walls thin or with trigones; cells containing oil bodies as in *A. tenella*; green tissue fairly loose, the air chambers in 2 or 3 layers (in the median portion), those of the dorsal layer larger than the others and more or less subdivided by supplementary partitions (sometimes not quite reaching the epidermis), the chambers thus apparently more numerous than the pores; compact tissue occupying about two-thirds the thickness of the thallus in the median portion, thinning out gradually on the sides and extending about three-fourths the distance to the margin, composed of cells with thin unpitted walls; mycorrhiza not observed; ventral scales imbricated, deeply pigmented with purple except along the minutely and irregularly crenulate or denticulate margin, the cells containing oil bodies mostly 10 to 15, scattered, the appendages borne singly or in pairs, in the latter case sometimes more or less connate, subulate and long-acuminate, scarcely or not at all constricted at the base, mostly 0.7 to 1 mm. long and 0.2 to 0.3 mm. wide, hyaline, forming a conspicuous cluster at the tip of the thallus, the margin varying from entire to sparingly and irregularly dentate or spinose-dentate, the cells averaging about $55 \times 20 \mu$, not varying greatly in different parts, an occasional cell with oil bodies present in the basal portion; inflorescence paroicous or autoicous, the antheridia forming an irregular elongated median group close to the peduncle of the female receptacle or on a separate branch; ostioles low; no paleae present; peduncle arising from the apex of a leading branch, surrounded at the base by a dense cluster of hyaline lanceolate scales, otherwise naked, more or less pigmented, about 2 cm. long when well developed; disk of receptacle bluntly conical, about 3 mm. wide, covered with coarse and low tubercles, shortly 3 or 4-lobed, the lobes extending almost vertically downward, the margins and distinct membranous involucre entire or more or less sinuate; pseudoperianth white, mostly 8-cleft, the lanceolate divisions coherent at the apex; capsule opening by an irregular circular line above the middle, the operculum coming off in one piece; spores brownish yellow, 80 to 90 μ in diameter, with wavy, minutely and irregularly crenulate wings 10 to 12 μ wide along the edges, the whole surface covered over with a very fine and

often regular reticulum, with meshes about $2\ \mu$ wide, formed by delicate lines slightly darker than the rest of the wall and scarcely elevated above the general surface level, the surface otherwise smooth or with occasional low ridges or tubercles, these never forming a reticulum; elaters straight or slightly curved, yellowish brown, mostly 140 to 200 μ long and 10 to 14 μ wide, scarcely tapering toward the rounded ends, the median portion with 1 to 3 spirals, the ends with 1 or 2.

A rare alpine and arctic species, growing on soil among rocks; widely distributed in North America, Europe, and Asia, but still known from comparatively few stations. The following specimens have been examined:

YUKON: Hunker Creek, 1902, *J. Macoun* 61 (N. Y., Y.; cited by the writer, as *A. fragrans*, in *Ottawa Nat.* 17: 14. 1903).

BRITISH COLUMBIA: Telegraph Creek, 1887, *Dawson* 327 (N. Y.; cited by Underwood, as *A. fragrans*, in *Bot. Gaz.* 20: 61. 1895).

IDAHO: Kootenai County, 1891, *Leiberg* 37 (N. Y.; cited by Underwood, loc. cit.).

WASHINGTON: Near Fort Colville, 1861, collector's name wanting (N. Y.).

SWITZERLAND: Branson, near Martigny, *Schleicher* (N. Y.; probable type of *Marchantia fragrans* Schleich.); same locality, 1832, *Blanchet* (N. Y.); between the Riffel and the Gorner Grat, *Mitten* (N. Y.).

ITALY: Mont-Cenis, date and collector's name wanting (N. Y.).

AUSTRIA: Near Krems, *Baumgartner* (C. C. H., N. Y., U. S.; distributed, as *Hypenantron fragrans*, in *Krypt. Exsic. Mus. Vinden.*, no. 282).

The following authentic records for the species may likewise be of interest:

GERMANY: Various localities in the Harz Mountains, *Hampe*, *Wallroth*, *Quelle*, and others (frequently cited in literature).

FRANCE: Col de la Vanoise, 1893, *Sebille* (listed by Boulay in *Musc. France* 2: 187. 1904).

ITALY: Near Belluno, Cadore, *Pampanini*, and between the Col delle Erbe and the Ricordo Canias, Friuli, *DeGaspari* (both cited by Zodda in *Nuov. Gior. Bot. Ital.* 19: 31. 1912).

AUSTRIA: Groisbach and Dürnstein, *Baumgartner* (cited by Müller, in *Rabenhorst's Krypt. Fl.* 6: 273. 1907).

RUSSIA: Kongur, Perm, *Brenner*, *Arnell* (listed by Lindberg & Arnell, *Svensk. Vet. Akad. Handl.* 23^b: 10. 1889).

SIBERIA: Stolba, Yeniseisk, *Arnell* (cited by Lindberg & Arnell, loc. cit.); Poddale, Amur, *Maximowicz* (cited by Lindberg in *Acta Soc. Sci. Fenn.* 10: 259. 1872); Kamchatka, *Tilesius* (type locality for *Marchantia saccata*).

Several other records for the species may be found in the literature but are more or less open to suspicion. A few of these are noted below.

The synonymy of this rare species is very much involved, owing largely to the fact that the earlier writers confused it with the much more abundant *Grimaldia fragrans* (Balb.) Corda. The latter species was originally described and figured by Balbis,¹ under the name *Marchantia fragrans*, from specimens collected on the southern slopes of the Pennine Alps in northern Italy. A few years later Schleicher discovered *Asterella saccata* at the village of Branson, near Martigny, Switzerland, on the northern slopes of the same range of mountains, and distributed specimens under the name *Marchantia fragrans* Balb., supposing them to be identical with the Italian plant. Schleicher did not publish a description of these Swiss specimens but De Candolle did so, in 1805, the name assigned to them being "*Marchantia fragrans*

¹ *Mém. Acad. Sci. Turin* 12: 76, pl. 2. 1802-03.

Balbi ex Schleich." Similar descriptions were published soon afterwards by Weber and Mohr,¹ by Weber,² and by Wallroth.³

On the basis of these descriptions certain later writers have attempted to maintain a *Marchantia fragrans* Schleich. in addition to a *Marchantia fragrans* Balb., and have cited *A. saccata* under the name *Asterella fragrans* (Schleich.) Trevis. or *Fimbriaria fragrans* (Schleich.) Nees, according to their choice of generic names. This course has little to recommend it. The writers who described Schleicher's specimens supposed that they represented *M. fragrans* Balb., but even if they had considered them distinct the name "*M. fragrans* Schleich." would be nothing more than a homonym of *M. fragrans* Balb. and therefore without nomenclatorial standing.

The case is different with *Fimbriaria fragrans* Nees, the third species of Nees von Esenbeck's genus *Fimbriaria*, as originally described. As a synonym of this species *Marchantia fragrans* Balb. is unfortunately given, but the descriptions quoted are those of Weber and of Wallroth, instead of the original description of Balbis. It is evident, therefore, that Nees von Esenbeck's conception of *F. fragrans* was largely based on Schleicher's specimens, and for this reason it is perhaps justifiable to regard *F. fragrans* as a new and adequately published name. This was clearly the view held by Underwood⁴ when he wrote the name of the species *Asterella fragrans* (Nees) Trevis. But an alternate interpretation is possible: If the true *Marchantia fragrans* Balb. is considered synonymous with *F. fragrans* Nees, then the latter name becomes a mere synonym of *Grimaldia fragrans*.

The revival of Wahlenberg's *Marchantia saccata* removes the necessity of using the name *fragrans* at all in the present connection. *M. saccata* was based on specimens collected by Tilesius in Kamchatka, and Wahlenberg's figures, although not very satisfactory, clearly show the plurifid pseudoperianths of an *Asterella* with the segments connate at the apex. The species was accepted by Schwaegrichen⁵ and by Nees von Esenbeck, the latter author listing it as the second member of his genus *Fimbriaria*, under the name *F. saccata*. Wallroth, however, was apparently the first to recognize its close relationship to the *M. fragrans* of Schleicher's distribution, quoting it, in 1815, among the synonyms of *M. fragrans*. Later on, in 1831,⁶ he no longer included *M. saccata* among the synonyms, showing that he may have changed his mind. In his *Naturgeschichte der europäischen Lebermoose* (1838) Nees von Esenbeck makes no allusion to *F. saccata*, but the authors of the *Synopsis Hepaticarum*⁷ accept it, placing it close to *F. fragrans* and emphasizing its relationship to that species. Apparently no further attention was paid to Wahlenberg's species until Lindberg considered its status many years later. When he first referred to it he included it, with a question mark, among the synonyms of *Düvalia pilosa* (Hornem.) Lindb. (*Neesiella pilosa* Schiffn.),⁸ but he changed his mind afterwards, when he listed "*Fimbriaria fragrans* (Schleich.) N.-Es." from Amur in eastern Siberia,⁹ stating that "*F. saccata* (Wahlenb.) N.-Es." was very

¹ Bot. Taschenb. 391. 1807.

² Hist. Musc. Hep. Prodr. 106. 1815.

³ Ann. Bot. 120. pl. 6, f. 9. 1815.

⁴ Bot. Gaz. 20: 61. 1875.

⁵ Hist. Musc. Hep. Prodr. 33. 1814.

⁶ Fl. Crypt. Germ. 1: 44. 1831.

⁷ Page 559. 1846.

⁸ Not. Sällsk. Faun. Fl. Fenn. Förh. 9: 281. 1868.

⁹ Act. Soc. Sci. Fenn. 10: 259. 1872.

probably referable to *F. fragrans* as a synonym. In 1889 he and Arnell¹ spoke still more positively, saying that *Marchantia saccata* ought without doubt to be referred to *Asterella fragrans* (Schleich.) Trevis. Whether they based their statement on a study of Wahlenberg's type specimen, which is presumably at Upsala, does not appear but is surely to be assumed. In any case they would not have supplanted the name *fragrans* by the name *saccata* because they considered *Marchantia fragrans* Schleich. a valid species, antedating *M. saccata* Wahl. For those who can not accept this view, *M. saccata* represents the oldest valid name for the species.

Although Nees von Esenbeck does not refer to *F. saccata* in his *Naturgeschichte*, he gives a full account of *F. fragrans*² and establishes the generic position of the true *Marchantia fragrans*,³ citing the original publication of Balbis, with which his predecessors had apparently been unacquainted. He deplores the confusion caused by Schleicher's incorrect determination, but admits that he himself as well as others had not been blameless. As a matter of fact, Wallroth, to whom attention has already been called, had been a serious offender. In connection with his description of *M. fragrans* he cites specimens from the vicinity of Halle, Germany, which represent *Grimaldia fragrans*. This error was pointed out by Bischoff,⁴ who showed that Wallroth's figures were drawn partly from the true *F. fragrans* and partly from the *Grimaldia*. Other errors also, based on incorrect determinations, might be noted, including some that have appeared within comparatively recent times. Bernet,⁵ for example, writing in 1888, cites *F. fragrans* from a number of Swiss localities, most of which were afterwards transferred by Boulay⁶ to *Grimaldia fragrans*.

Wallroth's *F. umbonata*, based on specimens collected in the Harz Mountains, Germany, remains to be considered. This species was admitted to the *Synopsis Hepaticarum*,⁷ although attention is there called to the strong resemblance which it bears to *F. fragrans*. It is likewise listed by Hampe.⁸ Stephani,⁹ however, reduced it to synonymy in 1899, citing it under *F. fragrans*, and later writers, such as Loeske, Migula, and Müller, have followed his example.

The earliest record for *A. saccata* in North America was published by Austin¹⁰ in 1873, the specimens upon which it was based having been collected by Fendler at Santa Fe, New Mexico. So far as seen by the writer these specimens are either sterile or else show very immature receptacles. Their ventral scales, however, as well as their epidermal and photosynthetic tissues, differ from the corresponding structures in authentic material of *A. saccata*, and indicate a wrong determination. The North American records cited above, all but one of which have been previously published, seem to be trustworthy.

Although it would be impossible, in the light of our present knowledge, to confuse fruiting specimens of *Asterella saccata* and *Grimaldia fragrans*, the two species resemble each other very closely indeed in a sterile condition. They are both of about the same size; both have a markedly xerophytic habit, the thallus

¹ Svensk. Vet. Akad. Handl. 23^b: 10. 1889.

² Page 267.

³ Page 225.

⁴ Nov. Act. Acad. Caes. Leop. Carol. 17: 1019. 1835.

⁵ Cat. Hép. Suisse 124.

⁶ Musc. France 2: 190. 1904.

⁷ Page 559.

⁸ Fl. Hercyn. 374. 1873.

⁹ Bull. Herb. Boiss. 7: 211. 1899.

¹⁰ Hep. Bor. Amer., no. 136c (as *Fimbriaria fragrans*).

becoming strongly involute when dry; and both usually show a dense cluster of hyaline scale appendages at the apex. Under ordinary circumstances the *Grimaldia* can be recognized by its characteristic aromatic odor, the *Asterella* being odorless; but since the *Grimaldia* also sometimes lacks the odor, this difference can not always be relied upon. Even in their minute structure the species have much in common, the epidermis, the green tissue, and the scales being a good deal alike. In the *Grimaldia*, however, the epidermis is composed of smaller cells (averaging only $15\ \mu$ in length), the trigones are more conspicuous, and there are no cells containing oil bodies; the green tissue is a little more compact, the dorsal chambers being more subdivided; and the scales show a more abrupt transition between the basal portion and the appendages. The median cells of the basal portion, moreover, are distinctly smaller, averaging only $15\ \mu$ in width; in *A. saccata* they usually measure 20 to $30\ \mu$ in width.

Among North American species *A. saccata* is perhaps most closely allied to *A. palmeri*, a fact to which both Stephani and Howe have called attention. Both are xerophytic species, showing a thallus involute when dry, a rather compact green tissue, and large ventral scales. They agree further in the bluntly conical female receptacles with short and indistinct lobes and in the white pseudoperianths extending almost vertically downward. In most other respects they are amply distinct. In *A. palmeri*, for example, the compactness of the green tissue is due to the small size of the dorsal chambers, the epidermal cells are thin-walled and contain no oil bodies, the peduncle of the female receptacle is naked throughout, and the spores are dark brown and covered over with distinct rounded folds. In *A. saccata*, on the contrary, the compactness of the green tissue is due largely to the subdivision of the dorsal chambers, the epidermal cells show trigones and an occasional cell contains oil bodies, the peduncle of the female receptacle shows a basal cluster of hyaline paleae, and the spores are brownish yellow and usually show no distinct surface folds except the wings along the edges.

With regard to the male inflorescence the statements in the literature are not altogether in accordance, and the limited amount of material at the writer's disposal has made it impossible to decide some of the disputed points. The statements in the description have been taken largely from Bischoff's figures and explanatory text. According to his account the clusters of antheridia occur on both fertile and sterile thalli, forming median subconvex areas on the upper surface, not sharply limited but approximately oval or oblong in outline. According to Nees von Esenbeck's description the species is definitely paroicous; he compares it with *A. ludwigii* in this respect and states that the antheridia are found close to the female receptacle. Stephani describes the antheridia as occurring in small clusters but says nothing about their position with respect to the peduncle, except that the species is monoicous. Müller does not describe the male inflorescence at all, and Massalongo, apparently on the basis of very few observations, states that it occurs on an isolated branch and that the species is therefore not paroicous. The question deserves further study, but according to the evidence at hand both paroicous and autoicous conditions have been demonstrated.

6. *Asterella californica* (Hampe) Underw.

Sauteria limbata Austin, Proc. Acad. Phila. 1869: 229. 1869, in part.

Fimbriaria californica Hampe; Boland. Cat. Pl. San Francisco 40. 1870, nomen nudum; Underw. Bull. Ill. Lab. Nat. Hist. 2: 41. 1884.

Fimbriaria lescurii Austin; Boland. Cat. Pl. San Francisco 40. 1870, as synonym.

Asterella californica Underw. Bot. Gaz. 20: 60. 1895.

Clevea limbata Solms; Stephani, Bull. Herb. Boiss. 6: 773. 1898, in part.

Thallus green above but usually more or less pigmented with purple along the margin and on the ventral surface, mostly 1.5 to 2 cm. long and 7 to 10 mm. wide (rarely only 4 to 7 mm.), plane when moist, more or less incurved when dry, with undulate margins, branching by forking, the keel broad and rounded; epidermis composed of cells with thin walls, sometimes showing minute trigones, averaging about $50 \times 30 \mu$; pores slightly elevated, measuring (with their surrounding cells) mostly 110 to 130 μ in length and 100 to 120 μ in width, surrounded by 6 (sometimes 7 or 8) series of cells with 3 cells in each series, the radiating walls more or less thickened, the cells containing oil bodies as in *A. tenella*; green tissue rather loose, the air chambers in 4 or 5 layers in the median portion, those of the dorsal layer higher and larger than the others but somewhat subdivided by supplementary vertical partitions often reaching nearly or quite to the epidermis; compact tissue occupying from one-fourth to one-third the thickness of the thallus in the median portion, thinning out gradually on the sides and extending about halfway to the margin, composed of cells with thin unpitted walls, an occasional larger cell both here and in the green tissue containing slime; mycorrhiza rarely present in the ventral portion; ventral scales large and imbricate, extending beyond the margin, ovate to lunulate, deeply pigmented throughout or with hyaline appendages, the margin irregularly sinuate or toothed; cells containing oil bodies mostly 10 to 15, scattered; appendages mostly 2 to 4, variable in shape but usually narrowly subulate and acuminate from a broad triangular base, mostly 0.6 to 0.9 mm. long (including the basal portion) and 0.08 to 0.15 mm. wide, sometimes with a sharp tooth or lobe but usually entire, the cells in apical portion mostly 35 to 60 μ long and 25 to 35 μ wide; inflorescence dioicous; antheridia forming an elongated median patch, sometimes forked, at some distance from the apex; ostioles low; a few paleae sometimes present; peduncle straw-colored, sometimes with brownish or purplish pigmentation, naked or nearly so, 1 to 3 cm. high; disk of receptacle green, about 5 mm. across, low-hemispherical, deeply lobed, almost smooth, the lobes mostly 4 (sometimes 5), extending obliquely outward, the margins and the almost bipartite involucre entire or vaguely and irregularly crenate or dentate; pseudoperianth white or rarely purplish, mostly 12 to 16-cleft, the divisions lanceolate, connate at the apex; capsule circumscissile at the middle or above by an irregular line, the operculum breaking up into fragments; spores yellow, mostly 100 to 120 μ in diameter, with wavy wings 12 to 20 μ wide along the edges, the surface covered over more or less completely with a fine and often irregular reticulum with meshes 3 to 4 μ across, formed by delicate, slightly raised lines, the spherical face showing in addition 4 or 5 broad and rounded, irregular ridges lower than the wings, anastomosing but not forming a reticulum, the plane faces with 1 or 2 similar ridges; elaters yellow, variously curved, mostly 240 to 450 μ long and 12 to 16 μ wide, tapering slightly toward the blunt ends, the median portion with 1 or 2 spirals, the ends with 1.

Growing on banks or among rocks; locally abundant in California; known also from Arizona and Guadalupe Island. The following specimens have been examined:

ARIZONA: Bright Angel Trail, bottom of Grand Canyon, 1913, *Nichols* (Y.; listed by the writer, somewhat doubtfully, in *Bryologist* 20: 61. 1917).

CALIFORNIA: Without definite locality or date, *Bolander*, *Bigelow* (C., N. Y., Y.; distributed by Austin, as *Fimbriaria californica*, in *Hep. Bor. Amer.*, no. 135); Oak Run, Shasta County, *Baker & Nutting* (N. Y.); Ukiah and Half Way House, Mendocino County, *Howe* (N. Y.); Murphy, Calaveras County,

Davy (N. Y.) ; Duncan's Mills, Sonoma County, *Howe* (C. C. H., N. Y.) ; Olema, Marin County, *Jepson* (Y.) ; Mill Valley, Marin County, *Howe* (N. Y.) ; Marin County, *Parsons* (N. Y.) ; Mount Tamalpais, *Howe* (U. S.) ; Berkeley, *Howe* (N. Y., U. S.) ; San Leandro, *Underwood* (N. Y.) ; Mount Diablo, Contra Costa County, *Howe* (N. Y.) ; San Francisco and vicinity, prior to 1870, *Bolander* (N. Y.; type), *Rattan* 6452 (U. S.), *T. S. Brandegees* 3 (N. Y.), *K. Brandegees* (C. C. H.) ; Stanford University and vicinity, *Campbell* (N. Y., Y.) ; same locality, *Baker* (N. Y., C. C. H., U. S.; distributed in *Pacif. Sl. Bry.*, no. 763, as *Fimbriaria californica*) ; Santa Cruz, *Farlow* (N. Y., Y.) ; Kaweah River Valley, Tulare County, *Coville & Funston* 1304 (N. Y., U. S.; listed by Coville, as *Fimbriaria californica*, in *Contr. U. S. Nat. Herb.* 4: 230. 1893) ; Santa Barbara, *Farlow* 12 (N. Y.) ; Nordhoff, Ventura County, *Newton* (N. Y.) ; Pasadena, *Underwood* (N. Y.) ; same locality, *McClatchie* 26, 27 (N. Y.; listed by the collector, as *Fimbriaria californica*, in *Fl. Pasadena* 624. 1895) ; same locality, *Teed* (N. Y., U. S., Y.; distributed by Underwood & Cook in *Hep. Amer.*, no. 119, as *Fimbriaria californica*) ; same locality, *Kingman* 737 (C. C. H.) ; Millards Canyon, San Gabriel Mountains, *Kingman* 640 (C. C. H.; listed by the collector in *Bryologist* 14: 34. 1911) ; Verdugo Canyon, *Warner* (C. C. H.) ; Santa Monica, *Hasse* (N. Y.) ; Santa Anita Canyon, *Moxley* 455 (C. C. H., Y.) ; Santa Ana Hills, San Bernardino Mountains, *Parish* 1728, 1730 (N. Y.) ; San Diego, *Farlow* 14 (N. Y.) ; Twin Oaks, San Diego County, *Koch* (N. Y.) ; Witch Creek, San Diego County, *Alderson* 770, 903, 912 (C. C. H., N. Y.). Many of these specimens have already been listed by *Howe* (*Mem. Torrey Club* 7: 50. 1899).

LOWER CALIFORNIA : Guadalupe Island, 1875, *Palmer* 118 (N. Y.; listed by *Watson*, *Proc. Amer. Acad.* 10: 121. 1875), *Anthony* 5½ (N. Y.).

*Macoun*¹ lists the species from the following localities in British Columbia : Lytton, 1889, *J. Macoun*, and Pass Creek, Columbia River, *J. Macoun*. According to a specimen from Lytton in the herbarium of the Canadian Geological Survey, the first of these records was based on *Reboulia hemisphaerica*; in the absence of Pass Creek specimens the second record must therefore be considered as open to suspicion.

Underwood's original description of *Asterella californica* is incomplete but calls attention to the broad and "undulate-lobed" thallus with a brownish purple margin; to the stout, pale purple, and sparingly pilose peduncle; to the subhemispherical and usually 4-lobed receptacle; and to the large, 12 to 16-cleft pseudoperianth. *Stephani* supplies several additional details, emphasizing among other features the large purple scales with 2 or 3 lanceolate appendages, the distinctly bilabiate involucre, the yellow spores with broad and rough crests, and the unispiral or bispiral elaters. Unfortunately his description includes a few disconcerting statements about the branching and the inflorescence. He makes no mention whatever of branching by forking but describes the thallus as being simple or with apical innovations, and he assigns a monolcous inflorescence to the species, with androecia borne on minute ventral branches. These errors are not repeated by *Howe*, who correctly describes the branching as dichotomous and the inflorescence as dioicous, a full account of the male inflorescence being included. *Howe's* description and figures,² in fact, are so complete that they leave little to be desired. His discussion of *Austin's Sauteria limbata* is also of much interest. He shows clearly that the species is a composite, being based on male material of *A.*

¹ *Cat. Canad. Pl.* 7: 3. 1902.

² *Mem. Torrey Club* 7: 48. pl. 95, 96. 1899.

californica and female material of *Clevea hyalina californica* Howe. He recommends that in order to avoid confusion the specific name *limbata* be given up altogether, in spite of the fact that *Sauteria limbata* antedates *Fimbriaria californica* by several years.

The slime cells of *A. californica* have apparently been overlooked by previous observers. They occur without definite order in both green and compact tissues and are distinguished by their large size and colorless, highly refractive contents. They are sometimes more numerous in the green tissue, sometimes in the compact tissue, and sometimes equally numerous in both. In exceptional cases they may be very abundant, as many as 50 having been seen in a single section, but they are usually more scantily developed and may be absent altogether. Since slime cells have not been detected in other species of *Asterella*, their presence will sometimes help in the determination of sterile material.

The ventral scales of *A. californica* bear a certain resemblance to those of *Reboulia hemisphaerica* and have perhaps been the cause of confusion. In both plants the scales are characterized by slender and long-pointed appendages, their number varying from 1 to 3 or 4. In the *Asterella*, however, these appendages are subulate, tapering from a broad base, and are separated from one another by sharp sinuses; while in the *Reboulia* the appendages are linear from a very narrow base and are marked off much more sharply from the basal portion of the scale, being separated by a considerable length of margin. In the frequent possession of 3 or even 4 appendages the scales of *A. californica* are distinguished from those of most other species of *Asterella*.

Other unusual features of *A. californica* are the dioicous inflorescence, the deeply lobed female receptacle, and the bipartite involucre. The margins of the last are not always entire, as stated by Stephani. Those studied by the writer show scattered rounded teeth, some of which represent projecting cells, while others are 2 cells in length. The yellow spores, with their distinct marginal wings, fine surface reticulum, and sparsely developed ridges on the faces, are also very distinctive of the species. *A. californica* sometimes grows in company with *A. palmeri* and the two species resemble each other somewhat in a sterile condition, both having a more or less pigmented margin, which becomes incurved when dry, and both developing large purple ventral scales. *A. palmeri*, however, is a somewhat smaller plant, the dorsal air chambers are not subdivided, and the scales rarely have more than one appendage. Of course, if the conical and scarcely lobed female receptacles are present, the species can at once be distinguished.

7. *Asterella lindenbergiana* (Corda) Lindb.

Fimbriaria lindenbergiana Corda; Nees, Naturg. Eur. Leberm. 4: 283. 1838.

Fimbriaria maior Hampe; Nees, loc. cit., as synonym.

Marchantia alpina Schleich.; Nees, loc. cit., as synonym.

Fimbriaria bonjeanii DeNot. Mem. Accad. Sci. Torino II. 1: 335. pl. 1, f. e. 1839.

Asterella bonjeanii Trevis. Rend. Ist. Lombardo II. 7: 777. 1874.

Hypenantron bonjeanii Trevis. Mem. Ist. Lombardo III. 4: 440. 1877.

Asterella lindenbergiana Lindb. Musc. Scand. 1. 1879.

Hypenantron lindenbergianum Kuntze, Rev. Gen. Pl. 1: 89. 1891.

Fimbriaria commutata Stephani, Bull. Herb. Boiss. 7: 209. 1899.

Thallus sometimes green above but often more or less pigmented with red or purple on both surfaces, mostly 1 to 3 cm. long and 4 to 6 mm. wide, plane or with the undulate-crispate margins somewhat incurved when dry, usually with a shallow and narrow median furrow, branching by forking, the keel narrow and often sharp; epidermis composed of thin-walled cells without trigones, aver-

aging about $35 \times 25 \mu$; pores slightly elevated, measuring (with their surrounding cells) mostly 90 to 120μ in length and 80 to 110μ in width, surrounded by 6 or 7 (rarely 8) series of cells with 3 or 4 cells in each series, the radial walls slightly thickened; cells containing oil bodies as in *A. tenella*; green tissue fairly loose, the air chambers in 3 or 4 layers, those of the dorsal layer sometimes larger than the others but loosely subdivided by supplementary partitions often failing to reach the epidermis; compact tissue occupying from two-thirds to three-fourths the thickness of the thallus in the median portion, gradually thinning out on the sides and extending about two-thirds the distance to the margin, composed of cells with slightly thickened, more or less pitted walls; mycorrhiza not observed; ventral scales large, mostly ovate, sometimes sublunulate, pale purple throughout, marginal slime papillae somewhat persistent; cells containing oil bodies mostly 15 to 20, scattered; appendages mostly 1 or 2 (rarely 3), sometimes approximate or coalescent, lanceolate, scarcely if at all constricted at the base, mostly 0.25 to 0.4 mm. long and 0.08 to 0.12 mm. wide, acute to acuminate, entire or vaguely and minutely crenulate, the cells throughout averaging about $30 \times 20 \mu$; inflorescence parvicous or autoicous, the antheridia occupying an oval irregular median area near the peduncle of the female receptacle or on a separate branch, the ostioles low; peduncle with a loose cluster of lanceolate paleae at base and apex, deeply pigmented, mostly 1.5 to 2.5 cm. long; disk of receptacle mostly 3 to 4 mm. across, bluntly conical, coarsely tuberculate, the lobes mostly 3 or 4, short, extending obliquely downward, the margins and the narrow bilobed involucre entire or nearly so; pseudoperianth usually deep purple, mostly 12 to 16-cleft, the divisions lanceolate, connate at the apex; capsule purple, the method of dehiscence not observed; spores dark purple, mostly 80 to 100μ in diameter, with wavy irregular wings 10 to 14μ wide along the edges, the wings often becoming indistinct through the separation of the outer spore wall layer, the entire surface covered over with a fine reticulum, the meshes 4 to 6μ across, formed by delicate lines or low ridges, darker than the rest of the wall, coarser folds or ridges not present; elaters purple, more or less curved, mostly 100 to 120μ long (rarely up to 200μ) and 12 to 16μ wide, tapering slightly toward the rounded ends, the spirals mostly 2 in the middle and 1 or 2 at the ends, more deeply pigmented than the rest of the wall.

A rare alpine and arctic species, growing on soil among rocks, mostly calcareous; known with certainty only from western North America, Scandinavia, and the higher mountains of central Europe. The following specimens have been examined:

ALASKA: Aats Bay, 1913, *Frye* 921 (Y.; collected on the Kelp Expedition but not previously recorded).

BRITISH COLUMBIA: Selkirk Mountains, 1885, *J. Macoun* (C., U. S.; type collection of *Fimbriaria commutata*); near Kicking Horse Lake, *J. Macoun* (C.).

ALBERTA: Red Earth Creek, Long Lake, south of Pharaoh, 1913, *Brinkman* 983 in part (C. C. H.; mixed with *Bucegia romanica*); valley of Healy Creek, 1913, *Brinkman* 936 (C. C. H.).

WASHINGTON: Queets River Valley, 1907, *Frye* 71 (Y.); Elwha River Valley, *Frye* 33, 58, 63 in part (Y.); Paradise Park, Mount Rainier, *Foster* 1008 (C. C. H.). The first two stations have been reported by Miss Clark (Bull. Torrey Club 36: 300. 1909).

NORWAY: Tromsø amt, Bardodalen, Storfjeld, 1901, *Arnell* (N. Y.); Tromsø amt, Leaviken, Kistelfjeldet, *Kaalaas* (C. C. H.).

SWITZERLAND: "In Alpibus," 1849, *Lesquereux* (N. Y.); between the Riffel and the Gorner Grat, *Mitten* (N. Y.); Col de la Gemmi, *Lacoutre* (C. C. H.).

AUSTRIA: Salzburger Spitze des Unterberges, *Sauter* (N. Y., Y.; distributed in Gottsche & Rabenhorst's Hep. Europ., no. 369, as *Fimbriaria lindenbergi*-

ana); Tatry, *Raciborski* (C. C. H., Y.; distributed in Lillienfeldovna's *Hep. Poloniae Exsic.*, no. 6, as *F. lindenbergiana*).

The species has likewise been reported from Sweden, from the Bavarian mountains, from the French and Italian Alps, and from the Austrian provinces of Tirol, Styria, and Carniola.

Two names, *Fimbriaria lindenbergiana* Corda and *F. bonjeanii* DeNot., were published almost simultaneously for this distinct and beautiful species. *F. lindenbergiana* was based on three specimens, the first from the mountains of Salzburg, the second and third from the Faulhorn and the Gemmi, respectively, in Switzerland. The specimen from Salzburg was collected by Funck and should be considered the type of the species, since it was sent to Nees von Esenbeck by Lindenberg. The second and third specimens were collected apparently by Muhlenbeck, although this is not stated in the original description. *Fimbriaria bonjeanii* was based on material collected by Bonjean on Mont-Cenis, in northern Italy. In the Synopsis Hepaticarum *F. bonjeanii* is reduced to synonymy.

Underwood¹ has stated, however, that separates of the paper by DeNotaris, *Primitiae Hepaticologiae Italicae*, in which the description of *F. bonjeanii* appeared, were issued in 1838, a year earlier than the Memoir of the Turin Academy, in which the paper was included, was formally published. This being the case, doubt might be thrown upon the priority of *F. lindenbergiana*, which also was published in 1838. For a while certain Italian botanists, among whom Trevisan and Massalongo may be mentioned, attempted to maintain *F. bonjeanii* as a species, but when they admitted its identity with *F. lindenbergiana* they accepted Corda's specific name without question. Barsali, in fact, in his careful summary of the Italian literature on the Hepaticae,² gives 1839 definitely as the date for the paper by DeNotaris, and Massalongo³ has recently followed his example. The claims of *F. bonjeanii* may therefore be dismissed as baseless.

Asterella lindenbergiana was first reported from America by Gottsche, in 1864,⁴ his record being based on two specimens collected by Lindig in the province of Bogotá, Colombia. Schiffner, in 1893,⁵ listed the species not only from Colombia but also from Mexico. None of the specimens referred to have been available for study, and the writer is therefore unable either to verify or to correct these reports. At the same time the occurrence of the species in tropical America must be considered doubtful, in view of its distinctly northern distribution. The first record for northern North America was made by Miss Clark in 1909, on the basis of Frye's Washington material. Macoun's specimens from British Columbia, however, had been collected over twenty years earlier and had been listed by Pearson, in 1890,⁶ under the name *Fimbriaria violacea* Austin, probably on account of their purple pseudoperianths. Macoun repeated this record somewhat doubtfully in 1902,⁷ suggesting that the specimens might be referable to *Asterella fragrans* instead. Meanwhile Stephani, in 1899, had made them the type of his *F. commutata*. Through the kindness of Mr. J. M. Macoun, the writer has been able to make a careful

¹ Mem. Torrey Club 4: 21. 1893.

² Bibl. Epat. Ital. 12. 1902.

³ Atti Ist. Veneto 75: 719. 1916.

⁴ Ann. Sci. Nat. V. Bot. 1: 187. 1864.

⁵ In Engl. & Prantl. Pflanzenfam. 1³: 34. 1893.

⁶ List Can. Hep. 27. 1890.

⁷ Cat. Can. Pl. 7: 4. 1902.

study of the material from British Columbia and has no hesitation in referring it to *A. lindenbergiana*.

Although Stephani's description of the species mentions most of the more important characters, it is not altogether satisfactory. He says nothing, for example, about the characteristic spores and elaters, although Nees von Esenbeck had described them in his original account. Stephani likewise makes no allusion to branching by dichotomy, the usual method, stating that the thallus innovates at the apex or, more rarely, gives rise to ventral outgrowths. In his account of *F. commutata* he makes similar statements about the branching and describes the spores as $68\ \mu$ in diameter, yellowish brown, and with coarsely lobed wings, thus giving a somewhat misleading idea of their appearance. In all probability the capsules at his disposal, which he describes as subhyaline, were immature or abnormally developed.

There is little danger of confusing *A. lindenbergiana* with *A. saccata*, although they have certain structural features in common. The thallus of *A. lindenbergiana* is considerably the larger of the two and lacks the apical cluster of hyaline scale appendages, which forms so characteristic a feature of the smaller species. The sharp keel, which is of course seen with especial clearness in cross sections, is a peculiarity which distinguishes the plant not only from *A. saccata* but from most other members of the genus, and the deep purple pseudo-perianths, spores, and elaters are likewise very distinctive.

In the material from Mount Rainier a few ventral tubers were observed, similar to those described and figured by Karsten¹ in the case of *Conocephalum conicum* (L.) Dum. They represent intercalary outgrowths from the side of the keel, which easily become detached, and are in the form of solid spherical or ellipsoidal masses of cells. Scattered over the surface, especially at the apical end, a few narrow paleae can be detected, and the interior cells are gorged with food, some of which is a highly refractive fatty substance staining brilliantly with Sudan III. A small amount of starch also is present. In all probability these tubers serve as organs of vegetative reproduction, but in view of their apparent rarity their efficiency in this respect is doubtful. Bolleter² who has studied the tubers of the *Conocephalum* in some detail, emphasizes the fact that they are poorly adapted to withstand even short periods of dryness. In his experiments he rarely induced them to germinate at all and he suggests that our present *Conocephalum* may have descended from more xerophytic ancestors, in which the tubers played a more important part than they do now. As the habit of the plant gradually grew more hydrophytic the tubers may have lost their xerophytic features, becoming in time vestigial in character. In *Exormotheca tuberifera* Kashyap,³ a species recently described from the Himalayas, ventral tubers are associated with a distinctly xerophytic plant and apparently occur in abundance. No other instances of ventral tubers in the Marchantiaceae are known to the writer, although there are several cases in which the apex of an ordinary branch becomes tuberously thickened and often greatly modified.

8. *Asterella venosa* (Lehm. & Lind.) Evans.

Fimbriaria venosa Lehm. & Lind.; Lehm. Nov. Stirp. Pugill. 4: 29. 1832.

Hypenanthron venosum Trevis. Mem. Ist. Lombardo III. 4: 441. 1877.

Thallus very delicate, sometimes thin throughout but not infrequently more or less tinged with purple, the pigmentation occasionally extensive but usually

¹ Bot. Zeit. 45: 649-655. pl. 8. 1887.

² Beih. Bot. Centralbl. 18: 397. 1905.

³ New Phytol. 13: 309. 1914.

restricted to the ventral scales and contiguous portions of the ventral surface, mostly 1 to 2 cm. long and 2.5 to 4 mm. wide, plane or slightly concave above with thin, slightly sinuous-crispate margins, not incurved when dry, branching by forking, apical innovations sometimes present; keel broad and rounded; epidermis composed of cells with thin walls but sometimes with more or less distinct trigones, averaging about $35 \times 25 \mu$ (or a trifle more in shade plants); pores slightly elevated, measuring (with their surrounding cells) mostly 80 to 90μ in length and 50 to 65μ in width, surrounded by 7 or 8 (sometimes 6 or 9) series of cells with 2 or 3 cells in each series, the radial walls sometimes thin throughout, sometimes slightly thickened and showing more or less distinct trigones; cells containing oil bodies as in *A. tenella*; green tissue loose, the air chambers in 2 or 3 layers in the median portion, those of the dorsal layer larger than the others and sparingly subdivided by supplementary partitions; compact tissue occupying about one-half the thickness of the thallus in the median portion, thinning out rather abruptly on the sides and extending about one-third the distance to the margin, composed of cells with thin unpitted walls; mycorrhiza sparingly developed; ventral scales small, not overlapping, ovate, colorless or somewhat pigmented with purple, entire; cells containing oil bodies mostly 5 to 10, scattered; appendages borne singly (always, so far as observed), subulate from a broad and unconstricted base, mostly 0.25 to 0.4 mm. long and 0.12 to 0.18 mm. wide, acute to acuminate, entire, the cells mostly 40 to 50μ long and 20 to 25μ wide, occasional cells with oil bodies in the basal portion; inflorescence parvicous, the antheridia forming a small and irregular median group near the peduncle of the female receptacle, the ostioles low; peduncle with scattered slender paleae and a slightly denser cluster at the apex, usually green but sometimes purple at the base, about 1 cm. high; disk of receptacle mostly 3 to 4 mm. across, flat or nearly so above with a small, slightly elevated center, coarsely tuberculate, with low rounded tubercles, rugose when dry, normally 4-lobed, the lobes spreading almost horizontally, the involucre a thin membrane on the side next the peduncle, not bilobed but vaguely sinuate-crenate on the margin, barely reaching the margins of the lobes; pseudoperianth white or yellow, directed obliquely downward, mostly 8 to 10-cleft, the divisions narrowly lanceolate, connate at the apex; capsule yellow, circumscissile above the base by a very irregular line, the operculum coming off in one piece; spores yellowish brown, translucent, mostly 55 to 65μ in diameter, with wavy wings 8 to 10μ wide along the edges, the entire surface (including the wings) covered over with a fine and irregular reticulum formed of wavy and zigzag ridges about 1μ high slightly darker than the rest of the spore surface, the meshes mostly 1 to 4μ in diameter (rarely up to 6μ), coarser folds or ridges not present; elaters pale yellow, variously curved, mostly 180 to 200μ long and 6 to 8μ wide, tapering more or less toward their blunt ends, bispiral throughout or unispiral at the ends, the spirals pale and inconspicuous.

Growing on banks; known only from Brazil and Mexico. The following specimens have been examined:

FEDERAL DISTRICT OF MEXICO: Amecameca, 1908, *Barnes & Land* 339 in part (Y.; mixed with *Targionia hypophylla* L.); Cañada Santa Magdalena, *Barnes & Land* 441 (Y.).

PUEBLA: Banks along Avenida Hidalgo and path to barranca, Teziutlán, *Barnes & Land* 555 (Y.).

BRAZIL: Without definite localities or dates (N. Y.; two specimens, one collected by Klotzsch, the other by an unknown collector.)

The type specimens of this fragile species have not been studied by the writer. They were collected in Brazil by Sellow, no more definite locality being men-

tioned. In the Synopsis Hepaticarum the species is placed in the subgenus *Brachyblepharis*, being accepted without question, and no specimens except Sellow's are listed. Two years later, however, Lindenberg¹ reported it from Java, and this record was accepted by other writers on Javan liverworts, including Gottsche, Zollinger, and Sande-Lacoste. In 1898, Schiffner² still accepted this Javan record, expressing the opinion that *Fimbriaria khasiana* (Griff.) Mitt. and *F. leptophylla* Mont. of India might be synonyms of *F. venosa*. The following year Stephani, in his monograph, separated the Javan specimens from *F. venosa* and described them as a new species under the name *F. zollingeri*. Schiffner³ soon accepted this new species, changing the name to *Hypenantron zollingeri* and transferring to it as probable synonyms the two Indian species mentioned above. The range of the true *F. venosa* was thus again restricted to Brazil, and its discovery in Mexico marks an interesting extension. The Mexican plants have been carefully compared with the two Brazilian specimens in the herbarium of the New York Botanical Garden and agree in all essential respects.

The original description of *A. venosa* says little or nothing about the histological features or the spores and elaters, but emphasizes the usual green color and the extreme delicacy of the thallus, stating that the surface is covered over with anastomosing veins, visible to the naked eye. It notes also the orbicular disk of the female receptacle and the short pseudoperianths, these not reaching the margins of the disk. Perhaps the most serious errors are those connected with the male inflorescence, which is said to be on a distinct plant, the inference being that the species is dioicous. The receptacle is said further to be borne on a short peduncle and to be provided below with white follicles. It is, of course, obvious that these statements must have been based either on young female receptacles or on plants belonging to some other genus. In the Synopsis the male inflorescence is said to be unknown, but the description repeats most of the other statements made by the original authors. It gives additional details, however, about the size of the plant, the occasional lobing of the receptacle, the yellowish green, margined and reticulated spores, and the bispiral elaters.

Stephani supplies many other details and corrects the earlier statements about the inflorescence, showing that the antheridia are situated close to the peduncle of the female receptacle. His account of the epidermal pores, which states that the surrounding cells are in only 4 or 5 series, with 2 cells in each series, does not agree with the writer's observations, and the entire disk which he describes is evidently not a constant feature of the species. At the same time his description is trustworthy in most respects. The Javan *Fimbriaria zollingeri* is certainly a close relative of *A. venosa*, rivaling it in delicacy. The spores, however, will at once serve to distinguish it. In addition to a fine and delicate reticulum the spherical face shows a coarse reticulum, with meshes 20 to 30 μ across, formed by high ridges similar to the marginal wings.

Lehmann and Lindenberg compare their *F. venosa* with *F. tenella* and state that it differs sufficiently in its more delicate thallus, green both above and below and veiny on the upper surface; in the presence of slender paleae at the apex of the peduncle; and in the shorter divisions of the pseudoperianth, coherent at the apex. It might be added that the dorsal air chambers are subdivided, that the epidermal pores have more radiating series of cells around them, that the appendages of the ventral scales are smaller and apparently

¹ Meissner, Bot. Zeit. 6: 463. 1848.

² Consp. Hep. Arch. Ind. 43. 1898.

³ Fl. Bultenzorg 4: 23. 1900.

always entire, that the disk of the female receptacle is flat or nearly so, and that the spores lack a coarse reticulum on the spherical face. Among Mexican species *A. pringlei* bears a certain resemblance to *A. venosa*, in spite of its more xerophytic tendencies; but its undivided dorsal chambers, its smaller epidermal pores, the large and toothed appendages of its ventral scales, its autoicous inflorescence, its 12 to 16-cleft pseudoperianth, and its darker, almost opaque spores are distinctive characteristics.

9. *Asterella rugosa* Evans, sp. nov.

Thallus sometimes green throughout but usually with some purple pigmentation, especially along the margin and on the ventral surface, mostly 1.5 to 2 cm. long and 8 to 10 mm. wide, plane above or with a shallow median groove, the margins mostly crenate and closely undulate-crispate, not incurved when dry, branching normally by forking but sometimes by apical innovations or lateral intercalary outgrowths, the keel narrow but rounded; epidermis composed of cells with thin walls and small but very distinct trigones, averaging about $30 \times 25 \mu$; pores slightly elevated, measuring (with their surrounding cells) mostly 80 to 110 μ in length and 60 to 90 μ in width, surrounded by 6 (sometimes 5 or 7) radiating series of cells with 3 or 4 cells in each series, the radial walls more or less thickened and showing distinct trigones; cells containing oil bodies not abundant, much as in *A. tenella*; green tissue loose, the air chambers in 3 or 4 layers, those of the dorsal layer sparingly subdivided by supplementary partitions extending to the epidermis; compact tissue occupying about one-half the thickness of the thallus in the median portion, thinning out gradually on the sides and extending about one-fourth the distance to the margin, composed of cells with thin unpitted walls; mycorrhiza present; ventral scales small, narrowly to broadly ovate, usually purple throughout or with the tips of the appendages hyaline, the marginal slime papillae more or less persistent but inconspicuous; cells containing oil bodies mostly 15 to 20, scattered; appendages mostly borne singly but sometimes in pairs, not constricted at the base and not distinctly marked off from the basal portion, subulate from a broad base, mostly 0.45 to 0.6 mm. long and 0.15 to 0.2 mm. wide at the base, usually entire but sometimes with 1 or 2 coarse and irregular teeth, acuminate, the cells averaging $50 \times 20 \mu$; inflorescence dioicous (apparently); male inflorescence borne on a leading branch and not limiting its growth, consisting of a narrow elongated median group of antheridia without marginal paleae; ostioles long; female inflorescence borne on a similar branch; peduncle with a loose apical cluster of slender paleae, otherwise naked or nearly so, not pigmented, about 1 cm. long; disk of receptacle 3 to 4 mm. across, the upper surface slightly convex, covered with low and coarse tubercles, rugose when dry, scarcely or not at all lobed; involucre narrow, its features not clearly made out; pseudoperianths normally 4, extending almost vertically downward, white or brownish, mostly 12 to 14-cleft, the divisions lanceolate and coherent at the apex; capsule brown, its method of dehiscence not observed; spores brown, mostly 80 to 90 μ in diameter, with pale yellowish brown, wavy and vaguely crenulate wings 8 to 10 μ wide along the edges, the wings marked by narrow and low irregular and darker ridges, extending outward but growing narrower and paler toward the wing margins, the spherical face covered over with a fine and irregular reticulum, with meshes about 10 μ in diameter, inclosed by a system of anastomosing ridges similar to those on the wings, the plane faces with similar but lower and often indistinct ridges, sometimes almost smooth, coarser folds or ridges not present; elaters brown, more or less curved, mostly 140 to 200 μ

long and 12 to 18 μ wide, tapering slightly toward the blunt ends, usually with 2 spirals in the median portion for a variable distance and 1 at each end, sometimes with 1 to 4 rings instead of spirals at the ends, the walls between the turns of the spiral unpigmented or pale brown.

A mountain species, growing on shaded banks; known only from the following collections:

FEDERAL DISTRICT OF MEXICO: La Cima, alt. 3,000 meters, October 14, 1908, *Barnes & Land* 413 (Y.; type); same locality, July 17, 1908, *Pringle* 10682 in part (distributed in Pl. Mex., in admixture with *Plagiochasma crenulatum* Gottsche, under the name *P. muenchianum* Steph.).

The material of this new species is unfortunately so scanty that it has been impossible to determine the inflorescence with certainty. Three clusters of antheridia were observed, all on a single plant, and a female receptacle was present on a neighboring thallus, but it was impossible to demonstrate any connection between them. The male inflorescence bears a strong resemblance to that of the dioicous *A. californica*, which perhaps adds to the probability that *A. rugosa* also may be dioicous. The species derives its name from the finely crinkled appearance of the thallus along the margin. In typical cases this is distinctly fluted and stands in sharp contrast to the smooth surface of the thallus throughout the remainder of its extent.

In addition to the elongated male inflorescence, *A. rugosa* shares certain other features with *A. californica*, such as the large size of the thallus, the dichotomous branching, the green tissue with subdivided dorsal chambers, and the compact tissue with unpitted walls. There are, however, important differential characters. In *A. rugosa* the epidermal cells have distinct trigones; the green tissue is very loose, the dorsal chambers being sparingly subdivided; the ventral scales show only 1 or (rarely) 2 appendages; the disk of the receptacle is scarcely lobed; and the spores are brown, with the meshes of the fine surface network about 10 μ across, and without coarse folds or ridges of any kind (except the marginal wings). In *A. californica*, on the other hand, the epidermal cells are thin-walled throughout or show very minute trigones; the green tissue is somewhat more compact, the dorsal chambers being more abundantly subdivided; the ventral scales show 2 to 4 appendages; the disk of the receptacle is deeply lobed; and the spores are yellow, with the meshes of the network only 3 to 4 μ across, and with additional coarse ridges on the spore faces.

Among Mexican species it will be sufficient to compare *A. rugosa* with *A. pringlei* and *A. venosa*, both of which are distinctly smaller. In *A. pringlei* the green tissue, although somewhat more compact, shows no subdivision of the dorsal air chambers, each being clearly provided with an epidermal pore; the pores, moreover, are smaller, the appendages of the ventral scales are larger and usually more toothed, and the female receptacle is distinctly lobed. In *A. venosa*, which is perhaps the closest known ally of *A. rugosa*, the thallus is even more delicate; the inflorescence is paroicous; the disk of the receptacle is flatter, looser in texture, and usually lobed; the pseudoperianth is only 8 to 10-cleft (instead of 12-cleft or more); the spores are paler and show a finer surface network, the meshes being mostly only 1 to 4 μ wide; and the elaters are only 6 to 8 μ in diameter (instead of 12 to 18 μ).

10. *Asterella elegans* (Spreng.) Trevis.

Fimbriaria elegans Spreng. Syst. Veg. ed. 16. 4¹: 235. 1827.

Marchantia physocarpa Bertero; Spreng. loc. cit., as synonym.

Fimbriaria cub[an]ensis Lehm.; Mont. in Sagra, Hist. Cuba 9: 489. pl. 19, f. 3. 1845.

Fimbriaria elegans γ *cubensis* Gottsch., Lind. & Nees, Syn. Hep. 565. 1846.

Asterella elegans Trevis. Rend. Ist. Lombardo II. 7: 785. 1874.

Hypenantron elegans Trevis. Mem. Ist. Lombardo III. 4: 441. 1877.

Asterella cubensis Underw. Bot. Gaz. 20: 63. 1895.

Asterella austini Underw. op. cit. 64. 1895.

Asterella wrightii Underw. loc. cit.

Fimbriaria wrightii Stephani, Bull. Herb. Boiss. 7: 97. 1899.

Fimbriaria austini Stephani, op. cit. 203. 1899.

Thallus green above, usually more or less pigmented with purple on the ventral surface and along the margin, sometimes with scattered dots or splotches of purple on the upper surface, mostly 1 to 3 cm. long and 2 to 4 mm. wide (rarely up to 6 mm.), plane or slightly concave, with undulate and often crispate margins, often scarious when old and scarcely or not at all incurved when dry, rarely branching by forking, usually by means of apical innovations and ventral outgrowths, the keel broad and rounded; epidermis composed of cells with slightly thickened walls and sometimes with minute trigones, averaging about $50 \times 30 \mu$; pores distinctly elevated, measuring (with their surrounding cells) mostly 100 to 130 μ in length and 70 to 100 μ in width, surrounded by 6 to 8 (rarely only 5) radiating series of cells with 3 or 4 cells in each series, the radial walls slightly thickened; cells containing oil bodies scattered and few in the epidermis, otherwise as in *A. tenella*; green tissue compact, the air chambers mostly in 2 to 4 layers in the median portion, those of the deeper layers small, those of the dorsal layer higher and larger but subdivided by crowded vertical supplementary partitions failing to reach the epidermis in the vicinity of the pores; compact tissue occupying nearly or quite two-thirds the thickness of the thallus in the median portion, thinning out more or less abruptly on the sides and extending from one-third to one-half the distance to the margin, composed of cells with more or less thickened and distinctly pitted walls; mycorrhiza often abundant in the lower part; ventral scales ovate to lunulate, usually with purple pigmentation, the cells containing oil bodies mostly 6 to 15, scattered, tending to be more numerous in the acropetal portion; appendages usually borne singly but not infrequently in pairs, narrowly lanceolate or subulate, slightly or not at all constricted at the base, mostly 0.6 to 0.9 mm. long (rarely down to 0.35 mm.) and 0.09 to 0.15 mm. wide, the margin entire or vaguely crenulate from projecting cells, rarely bearing a single spinelike or cilium-like tooth near the base, the apex acuminate, the cells mostly 100 to 120 μ long and 30 to 40 μ wide; inflorescence autoicous; male inflorescence in the form of a clearly defined and slightly raised oval to emarginate disk, containing usually 15 to 30 antheridia and surrounded by a fringe of narrow paleae, terminal on a short or more or less elongated branch but sometimes with an apical innovation; ostioles distinctly elevated; female inflorescence borne on a similar branch; peduncle more or less pigmented with purple, bearing scattered lanceolate paleae along its entire length (at least when young) and a denser cluster at the apex, mostly 1 to 1.5 cm. high; disk of receptacle green or somewhat purple, mostly 3 to 4 mm. across, coarsely tuberculate, hemispherical in the center, normally 4-lobed, the lobes short but distinct, extending obliquely downward and outward, the margins crenate, the involucre rather broad, entire or sinuate, scarcely or not at all bilobed; pseudoperianth usually white to brownish but sometimes more or less purple, usually 8 but sometimes 9 or 10- (rarely 12) cleft, the divisions lanceolate, coherent at the apex; capsule brown, circumscissile above the middle by an irregular line, the operculum coming off in one piece; spores pale to dark brown, mostly 80 to 100 μ in diameter (rarely as low as 60 μ or as high as 120

μ), with wavy wings 8 to 20 μ wide along the edges, the margins of the wings broadened out and more deeply pigmented, marked with irregular points and lines, the surface of spore minutely and irregularly punctulate, the spherical faces showing in addition a coarse and usually regular reticulum, the meshes mostly 15 to 20 μ wide, inclosed by a system of high and thin ridges similar to the wings and usually involving the wings themselves, the plane faces covered by similar reticula; reticula sometimes irregular and incomplete, especially on the plane faces; elaters pale to dark brown, more or less curved, mostly 150 to 300 μ long and 12 to 14 μ wide, tapering slightly toward the blunt ends, sometimes unispiral or bispiral throughout but usually bispiral in the median portion for a variable distance and unispiral at the ends.

On rocks and banks, sometimes on coral formations; apparently restricted to the West Indies and especially abundant in Cuba. The following specimens have been examined:

CUBA: Without definite localities or dates, *Wright* (N. Y., U. S., Y.; one specimen, the type of *A. austini*, distributed in Austin's Hep. Bor. Amer., no. 136c, as *Fimbriaria elegans*; another specimen, the type of *A. wrightii*, distributed in Wright's Hep. Cub., as *F. tenella*; a third specimen, distributed in Hep. Cub., as *F. elegans*, and listed by Underwood, as *A. cubensis*, in Bot. Gaz. 20: 63. 1895); Monte Verde, Yateras, 1860, *Wright* (H., Y.); Arroyo de Piedra, 1858, *Wright* (H., Y.); Matanzas and vicinity, *Underwood* 2087 (N. Y.; listed by Underwood, as *A. cubensis*), *Britton, Britton & Shafer* 326, 352 (N. Y., Y.); Caverns of Thermopylae, Monte Libano, Oriente, *Maxon* 4262 (N. Y., U. S., Y.; also distributed, as *Hypenantron elegans*, in Crypt. Exsic. Mus. Vinden., no. 1689); Arroyo Trinitario (Río Negro) and Arroyo Grande, Trinidad Mountains, Santa Clara, *E. G. Britton* 5204, 5483 (N. Y., Y.); Ranchuelo, Santa Clara, *Cuesta* 989, 991 (N. Y., Y.); Rincón to Banaó, Santa Clara, *Shafer* 12325 (N. Y., Y.); vicinity of Mal Paso, Río San Miguel, Pinar del Río, *Wilson* 9301, 9363 (N. Y., Y.); between Bahía Honda and Baños Aguacate, Pinar del Río, *Wilson* 9217 (N. Y., Y.); Río Mestanza, Pinar del Río, *Britton, Britton & Cowell* 10160 (N. Y., Y.); Bahía Honda to El Rosario, *Shafer* 12048 (N. Y., Y.); Ripreso del Guaso, *Hioram & Batiste* 1507 (N. Y., Y.); Caracusey Valley, Bana Mountains, Santa Clara, *León & Roca* 8349.

HISPANIOLA: Santo Domingo, 1871, *Wright, Parry & Brummell* (U. S., Y.).

PORTO RICO: El Yunque, 1902, *Evans* 87 (N. Y., Y.); Río Prieto and vicinity, Sierra de Naguabo, *Shafer* 3695 (N. Y., Y.).

JAMAICA: Chestervale, 1903, *Underwood* 1143 (N. Y.); Mabess River, *Evans* 288 (Y.).

The following West Indian specimens, cited from the literature, are also of interest:

CUBA: Banks of the Carima River, 1839, *Otto* (type of *Fimbriaria cub[an]ensis*).

HISPANIOLA: Without definite locality, date, or collector's name (type of *F. elegans*); Santo Domingo, *Eggers* (listed by Stephani, as *F. elegans*, in Bull. Herb. Boiss. 7: 199. 1899).

The original material of *Fimbriaria elegans* came from the island of Hispaniola, no further data being supplied. In all probability it was collected by the Italian botanist Bertero, who visited the West Indies in 1821, since one of his manuscript names is quoted by Sprengel as a synonym. This original material is not represented in any of the herbaria consulted by the writer. In its absence it has seemed justifiable to associate the name *A. elegans* with the commonest and most widely distributed of the West Indian species, more especially since this agrees in all essential respects with the original diagnosis

and with the longer description of Lehmann and Lindenberg,¹ drawn up from the type material. This species, as the writer understands it, has not yet been found on the American mainland or in the Old World, although *A. elegans* has been reported from several widely separated localities in both hemispheres, most of the records (in the writer's opinion) being based on incorrect determinations. As a matter of fact, the species is exceedingly variable and has a number of close allies, some of which are distinguished with difficulty.

Among the features emphasized by Sprengel the tuberculate, 4-lobed female receptacle and the pilose peduncle are especially worthy of mention. Lehmann and Lindenberg, without alluding in any way to the histological features or the male inflorescence, add a few important details about the thallus and the female receptacle. They estimate the size of the thallus as 0.6 to 1.2 cm. \times 3 mm., and describe the upper surface as glaucous green with white dots (the epidermal pores) and the margin and lower surface as purple; they allude also to the occurrence of apical innovations. They describe the pseudoperianths as hyaline or purple, with 6 to 8 linear divisions, coherent at the apex; the spores as purple and marginate; and the elaters as simple and purplish, each in a narrow tube, thus implying a unispiral condition.

Among the suspicious or incorrect records the one made by DeNotaris² in 1839 should be particularly mentioned. On the basis of a specimen collected by Thomas on the island of Corsica he reported the species as European. Corsica has since been bryologically explored with considerable care, especially by Camus,³ but no additional material of *A. elegans* has come to light, and nobody has reported it from other parts of Europe. In spite of this meager evidence the species has been quoted as European by Underwood, Stephani, Müller, Massalongo, and other recent writers. Boulay,⁴ however, refers rather vaguely to certain old reports of *F. elegans* in France and states that they were based on *Grimaldia fragrans*. Whether this statement applies to the Corsican record is not definitely brought out. It is to be hoped that European botanists may take the trouble of studying the specimens in the DeNotaris Herbarium at Turin and of determining their true status.

In proposing *F. cub[an]ensis* Lehm. as a new species Montague compared it with *F. elegans*, describing the thallus as shorter, broader, and not convolute from ascending borders, and the receptacle as barbate below. The illustrations, drawn by Gottsche, show, among other details, female receptacles with the disks covered over with low tubercles; peduncles bearing scattered paleae with a denser tuft at the apex; both male and female receptacles borne on more or less elongate branches, broadening out from a stalklike base and thus implying a ventral origin; ventral scales not crowded, ovate and gradually narrowed to a subulate acuminate appendage; dark brown spores showing a paler wing and (in the case of a crushed spore) a fairly regular reticulum; and 3 short elaters, 2 with a single spiral each and the third with more than 1 spiral. It will be seen at once that these characters are hardly sufficient to separate a species, a conclusion which was reached by the authors of the Synopsis Hepaticarum and afterwards by Montagne⁵ himself.

In the Synopsis, *F. elegans* is again described but no very important character is added except that the ventral scales sometimes show two appendages. The authors recognize, however, 5 distinct forms or varieties and assign to

¹ Lehm. Nov. Stirp. Pugill. 4: 28. 1832.

² Mem. Accad. Sci. Torino II. 1: 335. 1839.

³ Bull. Soc. Bot. France 48: cli-clxxiv. 1902.

⁴ Musc. France 2: 190. 1904.

⁵ Syll. Crypt. 92. 1856.

the species certain Mexican and Indian specimens. These forms, with their respective ranges, are as follows: α (with no special name), from Hispaniola and Corsica; β *beyrichiana*, from Mexico; γ *cubensis* (based on Lehmann's species), from Cuba; δ *orientalis*, from Nepal; and ϵ *obtusata*, from Mexico. The writer suspects that the forms β and ϵ represent *A. lateralis*, to be discussed later on, but can make no positive statements in the absence of specimens; the form δ would probably now be referred to one of the recognized Indian species, although here again the matter must be left in doubt.

In 1851 Mitten¹ listed *F. elegans* from Ecuador, but this record, according to specimens in the Mitten Herbarium, was based on *Fimbriaria macropoda* Spruce. In 1856 Sullivant² listed it from Texas, a record based on *A. echinella*, as Underwood has since shown. In the same year Gottsche³ listed the species from Australia and in 1863⁴ added a new station for Mexico, but neither of these records can be accepted. The Australian plant would undoubtedly be referred to one of the many species of that region and the new Mexican record, as will be shown, was based on *A. lateralis*. In 1885 Spruce⁵ doubtfully referred to *F. elegans* additional material from Ecuador. His description is accurate but makes no mention of the male inflorescence or the capsule. Fortunately mature spores and elaters are present in the specimens which he afterwards distributed in his *Hepaticae Spruceanae* and show that they represent *A. lateralis*.

When Underwood revised the North American species of *Asterella* in 1895 he published a new description of *A. elegans*, citing it from Mexico, but not from the West Indies, and noting its occurrence in Europe and South America. The variety *cubensis* of the Synopsis he again elevated to specific rank and, further, proposed as new, under the names *A. austini* and *A. wrightii*, two other species based on Cuban material. Stephani, in his monograph of 1899, accepts *A. wrightii*, *A. cubensis*, and *A. austini* without question, transferring them to *Fimbriaria*, and quotes *F. elegans* from Santo Domingo and Cuba, as well as from Costa Rica, Mexico, Ecuador, and California (the last probably meaning Lower California). The writer, however, after a careful study of Underwood's descriptions and of the specimens upon which his Cuban species were based, has regretfully reached the conclusion that they represent forms of *A. elegans* and that they must therefore be reduced to synonymy.

In Underwood's descriptions little or nothing is said about the branching, the stomata, the green tissue, the ventral scales, or the male inflorescence, and the differences brought out are based on variable characters. To all three of the Cuban species which he recognizes he assigns a tuberculate female receptacle, an 8-cleft pseudoperianth (sometimes 9-cleft in *A. cubensis*) with coherent divisions, a peduncle about 1 cm. high and pilose at the apex, bispiral elaters, and a more or less marked purple pigmentation, the extent of which is sometimes left uncertain. His most important differences are derived from the spores: in *A. cubensis* these are said to be 95 to 105 μ in diameter, brown or purplish brown, opaque, and with a paler margin; in *A. austini*, 110 to 118 μ in diameter, yellow, distinctly reticulated, and broadly winged; in *A. wrightii*, dark yellow, otherwise as in *A. austini*. In his description of *A. elegans*, which was probably drawn from Mexican specimens, the spores are said to be 100 to

¹ Journ. Bot. Kew Misc. 3: 361. 1851.

² In A. Gray, Man. ed. 2. 688. 1856.

³ Linnaea 25: 561. 1856.

⁴ Dansk. Vid. Selsk. Skrivt. V. 6: 368. 1863.

⁵ Trans. Bot. Soc. (Edinburgh) 15: 563. 1885.

135 μ in diameter, dark purple or nearly black with a reddish border, reticulated when young and opaque when old; the pseudoperianth is described as 8 to 12-cleft with coherent divisions, the peduncle as 1 to 1.5 cm. high and pilose (especially at the apex), the elaters as bispiral, and the receptacle as convex, no tubercles being mentioned.

In recognizing Underwood's Cuban species Stephani discusses some of the features not alluded to in the original descriptions but brings out few additional differential characters. To all three species (as well as to *F. elegans*) he assigns apical innovations and ventral branches, a photosynthetic tissue with hairs in the chambers, at least under the pores (but see, in this connection, p. 252), and a female receptacle with high tubercles or papules. The pores are said to be surrounded by 6 radiating series of cells, with 3 cells in each series in *A. wrightii* and *A. austini*, 4 or 5 in *A. elegans*, and 5 in *A. cubensis*. In *A. cubensis* the spores are described as 90 μ in diameter, brownish red, with narrow papillate wings; in *A. wrightii* as 102 μ in diameter, orange-colored, with broad and rough yellow wings; and in *A. elegans* as 100 μ in diameter, reddish brown, with narrow and rough, entire wings; in *A. austini* the spores are not described. With regard to the appendages of the ventral scales, Stephani states that 1 or 2 may be present in *A. cubensis*, implying a single appendage in the other cases. In all four species the appendages are said to be long and narrowly lanceolate or filiform, a single marginal spine being occasionally present in *A. wrightii*. The position of the male inflorescence at the apex of a ventral branch—short in *A. elegans*, short or long in the three Cuban species—is likewise noted.

In order to show that the differences brought out by Underwood and Stephani are too slight and too inconstant, in the case of the Cuban species, to be considered specific, it will perhaps be justifiable to discuss the characters of *A. elegans*, as understood by the writer, in some detail. The thallus varies greatly in size and general appearance according to the environment. In dry localities it is usually only 2 to 3 mm. in width and may be even less; in moist and shaded localities it sometimes attains a width of 6 mm. The broader forms are often thin and delicate, but the narrower forms may be equally so, although they tend to be firmer and more compact. The amount of pigmentation also is subject to great variation. At one extreme the plants are green throughout; at the other the pigmentation involves the ventral scales, the spaces between the scales, the marginal portions of both surfaces, the peduncles and disks of the female receptacles, and the pseudoperianths. Even the dorsal surface of the thallus may be spotted or blotched with purple. The margins tend to become scarious with age but are not strongly incurved when dry, so that the species never presents a xerophytic appearance.

Branching by forking occurs occasionally but is infrequent, especially after the formation of the sexual organs has begun. The branching then is almost invariably intercalary, sometimes by means of apical innovations, but usually by means of ventral outgrowths. The sexual branches themselves vary greatly in length and in width, but their growth is always brought to an end by the development of the receptacles, whether male or female. A sexual branch, however, especially if elongated, may give rise to an apical innovation or to lateral branches, these in turn bearing new receptacles. A sexual branch if elongated is usually relatively broad; if abbreviated, relatively narrow. In one observed instance a long branch bore a female receptacle and 6 lateral branches, 4 of which (2 male and 2 female) were very short, while the other 2 (1 male and 1 female) were more elongated, though less than half the length of the original branch; one of the longer branches bore 2 short lateral branches

(one male and the other female), while the other bore a single short (female) lateral branch. In another instance a long branch bore a male receptacle, a short apical innovation (also male), and 5 short lateral branches (4 female and 1 male). These examples will give some idea of the variability encountered.

In its histological features the thallus shows a delicate epidermis with slightly thickened walls and sometimes with minute trigones, the cells with oil bodies being few and scattered. The pores have a broad membrane around the opening and each is usually surrounded by 6 to 8 radiating series of cells with 3 or 4 (rarely only 2) cells in each series. The writer has not yet observed 5 cells, although Stephani gives this number as characteristic of *A. austini*. The green tissue shows much uniformity, although its thickness may vary from 0.15 mm. to 0.3 mm. in different specimens. The crowded supplementary partitions in the dorsal chambers often give the effect of filaments, in cross sections of the thallus, especially beneath the pores, where they fail to reach the epidermis. The compact tissue, composed of cells with numerous minute pits in the walls, occupies a strand, plane or slightly convex above; in the latter case the green tissue is a little thicker over the sides of the strand than over the middle, and the more deeply situated air chambers in this region are distinctly larger than elsewhere. Mycorrhiza seems to be almost invariably present. The cells containing the hyphae tend to form a definite strand in the compact tissue, elliptical in section and variable in size. Their walls may be quite colorless but are usually purple, even in plants which are otherwise colorless. They are distinctly thinner than the walls of the cells without hyphae.

The ventral scales never extend beyond the margins, except in the apical region, but show great variation in size and in extent of pigmentation. Each scale contracts gradually into 1 or 2 appendages without showing a sharp line of demarcation. In the basal portion the marginal cells are slightly smaller than the median cells, and the slime papillae are usually short-lived and inconspicuous, especially on deeply pigmented scales. The appendages are long-subulate or lanceolate, running out into slender cuspidate or filiform points. In most cases their margins are entire; they may, however, be vaguely crenulate, and occasionally a marginal spine or cilium is present at the base (as Stephani described for *A. wrightii*). But even in plants where such spines occur they seem to be exceptional, many of the appendages being without them, so that they can not be considered of specific importance.

The male receptacle is much more clearly defined than in the preceding species and is further distinguished by the fact that it always limits the growth of the male branch. It consists of a slightly elevated oval or circular disk, sometimes with an apical notch, and is surrounded by a fringe of slender paleae which shrivel with age and are sometimes difficult to detect. The number of antheridia varies but is usually rather large, and the ostioles are distinctly elevated, especially on young receptacles.

The peduncle of the female receptacle varies in length and the size of the disk also varies somewhat, according to the vigor of the plant and the number of fertilized archegonia. The disk shows a central, strongly convex area and, in typical cases, 4 lobes extending obliquely downward and about as long as the diameter of the central area; sometimes the number of lobes is reduced to 3, 2, or even 1. The upper surface of the disk is covered over with coarse tubercles, each with an apical pore, these tubercles being especially prominent in the central area. The paleae of the peduncle are scattered except in the apical region and become much less conspicuous with age. The disk is usually green but sometimes shows a little purple pigmentation; the peduncle, on the

other hand, is almost always purple throughout the greater part of its length. The involucre, which consists of a fairly wide membrane without a special indentation next the peduncle, is continuous with the outer margin of a lobe, a tubular sheath being thus formed around each capsule. The margin of the involucre is entire or nearly so. The pseudoperianths, varying in color from white or yellowish white to purple, are inconspicuous and are usually 8-cleft, although pseudoperianths with as many as 12 clefts exceptionally occur. The segments are rather broadly lanceolate and cohere at the apex.

The operculum of the brown capsule, although coming off in one piece, has an exceedingly irregular outline. It leaves behind a broad urn with a coarsely dentate or crenate margin. The cells of the operculum have conspicuous trigones and the same thing is true of the teeth of the urn, but the remaining cells of the capsule wall are rather thin and without trigones.

The spores yield some of the most important characters of the species, in spite of the range in the amount of pigmentation and in size which they exhibit. Their color is usually some shade of brown; it may be a pale yellowish brown, a deep blackish brown, or some intermediate shade. The paler spores show the surface markings clearly, but the dark spores are sometimes so opaque that the markings are distinguished with difficulty. The diameter of the spores is usually 80 to 100 μ , but spores as small as 60 μ or as large as 130 μ in diameter occur. In one instance the spores from a single capsule varied from 80 μ to 110 μ in diameter. The surface of the spore is minutely punctulate; it shows in addition distinct wings along the 6 edges and a system of anastomosing ridges similar to the wings on the 4 faces, in typical cases forming regular networks in which the wings take part. The meshes of these networks, however, are often incomplete, the networks in consequence being irregular. The wings around the spherical face are 10 to 20 μ wide, those separating the plane faces mostly 8 to 10 μ wide, while the ridges are mostly 8 to 15 μ wide. When the networks are regular there are usually 6 or 7 meshes across the spherical face and about 4 meshes across each plane face from base to apex. The wings and ridges are not only wavy, crenulated, and more deeply pigmented (in the case of pale spores) on their margins, but broaden out distinctly and show an irregular system of fine dots and lines when seen on edge.

The elaters vary considerably in length and in diameter; most of them are 150 to 300 μ in length and 12 to 14 μ in diameter, but extremes of 100 μ and 400 μ in length and of 10 μ and 18 μ in diameter have been observed. The majority of the elaters show 2 spirals in the median portion for a variable distance and 1 spiral at each end, but elaters unispiral or bispiral throughout exceptionally occur.

It has already been noted that the most important characters of Underwood's three Cuban species were drawn from the spores. In the Matanzas material of *A. cubensis*, from which his description was probably drawn, the spores show the deep coloration and opacity which he assigns to them, but they show in addition, after soaking in glycerin, a distinct and regular reticulum formed of wings and ridges, essentially like the regular reticulum found in typical *A. wrightii* and the more irregular reticulum found in typical *A. austini*. The spore differences, therefore, easily come within the range of variation which the writer associates with *A. elegans*. Since the same thing is true of the slight differences in the epidermal pores and ventral scales, to which Stephani has called attention, the claims of the species for recognition clearly break down. In the writer's opinion, as will be shown later, most of the specimens which Underwood and Stephani have referred to *A. elegans* belong rather to *A. lateralis*, a close relative of the mainland.

11. *Asterella echinella* (Gottsche) Underw.

Fimbriaria echinella Gottsche, Dansk. Vid. Selsk. Skrivt. V. 6: 367. 1863.

Asterella echinella Underw. Bot. Gaz. 20: 62. 1895.

Thallus essentially like that of *A. elegans* and the branching of the same type; epidermis composed of cells with slightly thickened walls but without trigones (so far as observed), averaging about $50 \times 25 \mu$; pores slightly elevated, measuring (with their surrounding cells) mostly 80 to 100 μ in length and 70 to 90 μ in width, surrounded usually by 6 to 8 series of cells with 3 cells in each series; green and compact tissues, in relative amount and in structure, as in *A. elegans*; ventral scales ovate to narrowly lunulate, the appendages borne singly or sometimes in pairs, narrowly subulate, acuminate, entire or nearly so, mostly 0.6 to 0.9 mm. long and 0.07 to 0.12 mm. wide, the cells usually 75 to 110×25 to 30μ ; inflorescence autoicous; male inflorescence terminal on a more or less elongated branch, sometimes innovating at the apex, in the form of an oval to obcordate, slightly elevated disk, surrounded by a fringe of slender paleae, the antheridia (according to Gottsche) 50 to 60; female inflorescence borne on a short or more or less elongate branch; peduncle mostly 1 to 1.5 cm. high, not pigmented (so far as observed), bearing long scattered paleae especially at the apex; disk of receptacle 0.5 to 1 mm. long, hemispherical in the center, normally 4-lobed as in *A. elegans*; pseudo-perianth white or somewhat tinged with purple, mostly 8 to 10-cleft, the divisions lanceolate, coherent at the apex; capsule as in *A. elegans*, the operculum separating by an irregular line and coming off in one piece; spores pale to dark brown, mostly 60 to 100 μ in diameter (rarely as low as 50 μ or as high as 110 μ), with wings 8 to 10 μ wide on the edges, the margins of the wings broadened out and more deeply pigmented, marked with irregular dots and lines; surface of spore minutely and irregularly punctulate, the spherical face showing in addition a coarse and usually regular reticulum, the meshes mostly 15 to 20 μ wide, inclosed by a system of narrow ridges 6 to 8 μ high and similar to the wings, and usually by the wings as well, the plane faces with similar reticula; reticula often incomplete or irregular, especially on the plane faces; elaters pale to dark brown, more or less curved, mostly 140 to 200 μ long and 12 to 14 μ wide, often unispiral throughout but not infrequently bispiral in the middle for a variable distance and unispiral at the ends.

On rocks and banks, Arkansas to Mexico. The following specimens have been examined:

TEXAS: Without definite locality, 1849, *Wright* (H., N. Y., Y.; listed as *Fimbriaria elegans* by Sullivant in A. Gray, Man. ed. 2. 688. 1856; listed also by Underwood in Bot. Gaz. 20: 62. 1895); without definite locality, *McAllister* (N. Y., Y.).

VERACRUZ: Orizaba, 1853 and 1855, *Müller* 2245, 2285 in part, 2327 (N. Y., U. S.; including the type of *F. echinella*); along Mexican Railway above Fortín, Orizaba, *Barnes & Land* 630 (Y.); Huantica, *Ervendberg* (H., Y.).

The following record is quoted from Stephani's monograph:

ARKANSAS: Without definite locality or date, *Trécul*.

Gottsche's original description of *Fimbriaria echinella* is so full and accurate that the writer has been able to add very little to our knowledge of the species. In addition to the long tubercles of the female receptacle, which give the species its name, Gottsche mentions, among other important features, the lateral branches and apical innovations and associates the receptacles with them, noting that the sexual branches may be elongate. He gives, further, unusually good descriptions of the spores with their reticulate markings and of

the elaters, noting the frequent occurrence of 2 spirals in the middle and 1 at each end.

Stephani, in his description, adds details about the epidermis and green tissue, which were not considered in the original account. As in the case of *A. elegans* and certain other species, he alludes to filaments in the air chambers, but describes them as very short, often reduced to a single cell. In a few cases, where he deviates from Gottsche's description, he introduces incorrect or at any rate misleading statements. He states definitely, for example, that the male branches are short, thus giving no idea that they vary in length. He states further that the elaters are bispiral and that the spores are reddish, $63\ \mu$ in diameter, and lobate-cristate. He thus tells us nothing about the unispiral and partially unispiral elaters or about the conspicuous reticulations on the surface of the spores, although these features were clearly brought out by Gottsche and are well shown by the type material, which Stephani doubtless examined. The size of the spores is also far more variable than he implies.

The writer feels considerable hesitation in accepting *A. echinella* as a valid species, on account of its very close relationship to *A. elegans*. Except for the fact that the tubercles of the female receptacle are longer in *A. echinella* than in *A. elegans*, the two species are essentially alike. This is indicated by the descriptions. Even when the features of *A. echinella* are considered in detail for the sake of completeness, no other important differences are brought out. Whether it is justifiable to base a species on a single character and especially on a character subject to variation is perhaps questionable. It may be noted, however, in support of such an action, that the very long tubercles of *A. echinella* certainly give the plants a distinctive appearance and that the known ranges of *A. echinella* and *A. elegans* do not overlap. There occurs in Mexico, moreover, another species, *A. lateralis*, which is likewise very close to *A. elegans* but which has shorter tubercles. There is no evidence that this species intergrades with *A. echinella*, and the three species might well be considered as forming a series with *A. elegans* in the middle. Of course later investigations may prove the instability of these ideas.

12. *Asterella lateralis* Howe.

? *Fimbriaria elegans* β *beyrichiana* Gottsch., Lind. & Nees, Syn. Hep. 565. 1846.

? *Fimbriaria elegans* ϵ *obtusata* Gottsch., Lind. & Nees, loc. cit.

Fimbriaria quitensis Spruce, Trans. Bot. Soc. (Edinburgh) 15: 563. 1885, as synonym.

Asterella lateralis Howe, Bull. Torrey Club 25: 189. 1898.

Fimbriaria lateralis Stephani, Bull. Herb. Boiss. 7: 201. 1899.

Thallus much like that of *A. elegans* but more xerophytic in habit, the margins more or less incurved when dry and the ventral pigmentation usually more intense, mostly 1 to 2 cm. long and 2 to 4 mm. wide, rarely forking, almost always ventrally branched, the sexual branches (with rare exceptions) very short; epidermis composed of cells with somewhat thickened walls but rarely with trigones, averaging about $55 \times 28\ \mu$; pores distinctly elevated, measuring (with their surrounding cells) mostly 120 to $160\ \mu$ in length and 90 to $110\ \mu$ in width, surrounded usually by 8 (sometimes 9 or 10, rarely 4 to 7) radiating series of cells with 3 or 4 cells in each series, the radial walls slightly thickened; cells containing oil bodies as in *A. elegans*; green tissue compact, the air chambers mostly in 3 or 4 layers, similar to those of *A. elegans*; compact tissue occupying from one-half to two-thirds the thickness of the thallus in the median portion, thinning out gradually on the sides and

extending about halfway to the margin, composed of cells with distinctly thickened and pitted walls; mycorrhiza often present; ventral scales ovate to lunulate, deeply pigmented throughout or with hyaline borders, in the latter case often with more or less persistent slime papillae; cells containing oil bodies mostly 15 to 20, scattered, tending to be more numerous in the acropetal portion; appendages borne singly or in pairs, sometimes bleached out, slightly or not at all contracted at the base, narrowly lanceolate or subulate, mostly 0.8 to 1 (rarely only 0.5) mm. long and 0.13 to 0.18 (rarely only 0.1) mm. wide, acuminate, entire or nearly so, the cells mostly $70 \times 40 \mu$; inflorescence autoicous; male inflorescence borne on a very short and slightly expanded ventral branch, consisting of a small and not clearly defined cluster of antheridia with occasional narrow paleae at the edge; ostioles short but distinct; female inflorescence borne on a very short (rarely slightly elongated) ventral branch, more expanded than the male branch and often obcordate; peduncle more or less pigmented with purple, pilose in the upper part, especially at the apex, becoming naked below, mostly 1 to 2 cm. high; disk of receptacle mostly 2.5 to 3.5 mm. across, covered with low tubercles, those of the lobes often larger and more conspicuous than those of the hemispherical disk, the lobes mostly 4, distinct, spreading obliquely downward, the margins crenate, the involucre rather broad, entire or sinuate, slightly indented in the middle but scarcely bilobed; pseudoperianth white or rarely purplish, mostly 8 to 10-cleft (rarely up to 12-cleft), the divisions extending about halfway to the base, lanceolate, connate at the apex; capsule as in *A. elegans*; spores pale yellowish brown to dark purplish brown, mostly 90 to 120 μ in diameter, with wavy wings 10 to 20 μ wide along the edges, the margins of the wings often more deeply pigmented and very minutely crenulate; the entire surface of spore minutely and densely punctulate but nowhere with distinct lines, the spherical face showing in addition a coarse and sometimes regular reticulum, the meshes mostly 18 to 20 μ across, inclosed by a system of thin ridges similar to the wings but only 6 to 8 μ wide, very rarely involving the wings, the plane faces with similar reticula; reticula often very irregular and incomplete, especially on the plane faces; elaters brown, the color sometimes affecting the thin parts of the wall, variously curved, mostly 200 to 240 μ long and 12 to 14 (sometimes up to 22) μ wide, scarcely tapering toward the blunt ends, usually with 2 spirals in the median portion for about one-third the length of the elater and 1 spiral at each end.

On banks, Mexico, Costa Rica (?), and Ecuador. The following specimens have been examined:

FEDERAL DISTRICT OF MEXICO: Near Toluca, 1903, *Rose & Painter* (Y.); Amecameca, *Pringle* 10674 (Y.; distributed by Pringle in Pl. Mex. as *Fimbriaria austini*), *Barnes & Land* 340 (Y.); Cañada Santa Magdalena, Contreras, *Barnes & Land* 429.

JALISCO: Río Blanco, 16 kilometers from Guadalajara, 1908, *Barnes & Land* 220 (Y.).

LOWER CALIFORNIA: Without definite locality, 1890-92, *T. S. Brandege* 3, 5, 8 (N. Y.; listed as *F. echinella* by Brandege in Proc. Calif. Acad. II. 3: 182. 1891; also, as *A. elegans*, by Underwood in Bot. Gaz. 20: 63. 1895).

MORELOS: Pasque, near Cuernavaca, 1908, *Pringle* 15320 (Y.; distributed by Pringle in Pl. Mex. as *Fimbriaria bolanderi* Aust. ?).

PUEBLA: Santa Barbara, near Puebla, 1909, *Frère Nicolás* 1 (Y.).

SAN LUIS POTOSÍ: Without definite localities, *Parry & Palmer* (N. Y.); in 1876, *Schaffner* 4 (N. Y.).

SINALOA: Colomas, foothills of the Sierra Madre, 1897, *Rose* (N. Y.; type).

TEPIC: Tepic, Sierra Madre, 1897, *Rose* (N. Y.; listed by Howe).

VERACRUZ: Orizaba, 1853, *Müller* 2285 in part (N. Y.; listed by Gottsche in Dansk. Vid. Selsk. Skrivt. V. 6: 272. 1863, as *F. elegans* γ *obtusata*); same locality, *J. G. Smith* (N. Y.); along the Coatepec road and railroad, *Barnes & Land* 557 (Y.); Córdoba, *Farlow* 15 (N. Y.; listed as *A. elegans* by Underwood).

ECUADOR: Near Baños, *Spruce* (listed by Spruce as *F. elegans* (?) and distributed under the same name in Hep. Spruceanae).

The following records for *F. elegans* in literature should probably be transferred to *A. lateralis*:

OAXACA: Near Comaltepec, *Liebmann* (listed in Syn. Hep. as ϵ *obtusata*).

VERACRUZ: Near Jalapa, *Beyrich* 64, *Schiede & Deppe* 110; Orizaba, *Liebmann* (all listed in Syn. Hep. as β *beyrichiana*).

COSTA RICA: Without definite locality, *Wendland* (listed by Stephani in Bull. Herb. Boiss. 7: 199. 1899).

ECUADOR: Canelos, *Spruce*.

The type material of *A. lateralis* is not in very good condition and the female receptacles are so dried and shriveled that they fail to give a very convincing idea of their true features. Even the spores and elaters give an impression of rather poor development. The second specimen which Howe cites, collected at Tepic, shows immature female receptacles, but the surface tubercles are distinct, those of the lobes being more pronounced than those of the central portion of the disk. In spite of his unsatisfactory material Howe has given a full and clear description of the species and the writer has been able to add very little to it. Howe's account of the spores, however, deserves some amplification, and his description of the elaters as "bispiral" does not bring out the fact that they are commonly unispiral at the ends.

Through the study of the rather extensive series of specimens listed above the writer has reached the conclusion that *A. lateralis* is not uncommon in Mexico, but that it has been confused with *A. elegans*. Whether the two varieties, *beyrichiana* and *obtusata*, of the Synopsis actually represent *A. lateralis* must of course remain doubtful in the absence of specimens, although Müller's plants from Orizaba, referred by Gottsche to the variety *obtusata*, are clearly the same as Howe's species.

According to the original description the spores are "brown, opaque, 75 to 90 μ , very minutely granulose papillate, the angles with a narrow concolorous margin, the faces exhibiting a few low ridges, these often uniting to form 2 to 4 shallow rather irregular areolae across each face, the more mature and opaque spores appearing simply warty-rugose in outline or subentire." When the spores are well developed, however, they are larger than this account indicates and show a more regular reticulum. The fact that the reticulum rarely involves the marginal wings will serve to distinguish the spores from those of *A. elegans* and other allied species. The wings in consequence appear homogeneous in texture except for the slightly darker margin, the entire surface being covered with crowded dots. Occasionally one of the ridges extends partly across a wing, giving the appearance of a dark line, but it usually thins out and disappears before reaching the margin. The wings and ridges do not show the marked broadening out on their edges which is so characteristic a feature in *A. elegans*, and there are usually no linear markings in this region.

The close relationship existing between *A. lateralis* and *A. elegans* has already been noted and has been brought out further by the descriptions. On the whole, however, the claims of *A. lateralis* for recognition as a species are considerably firmer than those of *A. echinella*. Aside from the differences in the spores and in the tubercles of the female receptacle, there are interest-

ing differences in the male branches. In *A. lateralis* these seem to be invariably short, extending but slightly beyond the margin of the thallus and not broadening out to any marked extent. Upon these branches the antheridia form a small group in a rather vaguely defined median area and show very few marginal paleae or none at all. In *A. elegans* the male branches vary greatly in size, some of them being 1 cm. long or more and correspondingly wide, and the numerous antheridia are situated on a clearly defined and slightly raised receptacle, surrounded by a fringe of paleae. The differences in the female branches, although less constant, are sometimes striking. In *A. lateralis* these are usually almost as short as the male branches, although they broaden out a little more; in *A. elegans* they vary in length to the same extent as the male branches. In exceptional cases, unfortunately, a female branch in *A. lateralis* may be somewhat elongated, so that this distinction must be used with caution.

13. *Asterella reticulata* Evans, sp. nov.

Thallus green above, usually more or less pigmented with purple on the ventral surface and along the margin, sometimes with scattered dots or splotches on the upper surface, mostly 1 to 3 cm. long and 2.5 to 5 mm. wide, plane or slightly concave with undulate, scarcely crispate, margins, often scarious when old and somewhat incurved when dry; branching (so far as observed) ventral, sometimes lateral, sometimes by means of apical innovations, in the latter case occasionally soon repeated, thus giving rise to a jointed appearance, the keel broad and rounded; epidermis composed of cells with somewhat thickened walls but without distinct trigones, averaging about $50 \times 25 \mu$; pores distinctly elevated, measuring (with their surrounding cells) mostly 110 to 140 μ in length and 80 to 120 μ in width, surrounded by 6 to 8 radiating series of cells with 3 or 4 cells in each series, the radial walls slightly thickened; cells containing oil bodies, green tissue, and compact tissue all as in *A. elegans*; mycorrhiza often abundant; ventral scales much as in *A. elegans*, the appendages usually borne singly but sometimes in pairs, narrowly subulate or lanceolate, mostly 0.75 to 0.9 mm. long and 0.12 to 0.15 mm. wide, the margin sometimes bearing a spinelike tooth near the base, the apex acuminate; cells as in *A. elegans*; inflorescence doubtful but probably autoicous; male inflorescence (only 2 cases observed) as in *A. elegans*, terminal on a more or less elongated branch; female inflorescence borne on a more or less elongated branch; peduncle pigmented with purple (except in the apical portion), bearing scattered lanceolate paleae with a denser tuft at the apex, mostly 1 to 1.5 cm. high; disk of receptacle purple (so far as observed), mostly 2.5 to 3 mm. across, covered with coarse but low tubercles, hemispherical in the center, normally 4-lobed, the lobes short but distinct, extending obliquely downward and outward, the margins and involucre as in *A. elegans*; pseudoperianth brownish, not pigmented with purple, mostly 8 to 10-cleft with lanceolate divisions coherent at the apex; capsule brown, circumscissile above the middle by an irregular line, the operculum coming off in one piece; spores rather dark brown, mostly 70 to 80 μ in diameter, with a wavy wing 3 or 4 μ wide and often 4 to 8 μ thick around the spherical face and much broader but otherwise similar wings along the other edges, the whole surface (except sometimes close to the wings) covered over with an irregular and fairly coarse reticulum, with meshes mostly 8 to 12 μ wide, inclosed by a system of narrow and thick ridges, these mostly 3 to 4 μ wide and equally thick, the broad edges of both wings and ridges marked by darker irregular lines and occasional lighter interstices, the surface otherwise smooth or vaguely and minutely punctulate; elaters pale brown, variously curved, mostly 200 to 250 μ long and 12 to 14 μ wide, tapering slightly toward the blunt

ends, usually bispiral in the middle for a variable distance and unispiral at the ends, rarely unispiral throughout.

On rocks; known only from the following locality:

CUBA: Monte Verde, Yateras, March 18, 1860, *Wright* (H., Y.).

It is with considerable hesitation that the writer proposes a new species on a single collection, more especially since this new species is closely allied to the variable *A. elegans*. There is, however, so marked a difference in the spore markings that this course appears justifiable. In *A. elegans* the wings and ridges of the spores are thin and wide and inclose a fairly regular reticulum with the meshes mostly 15 to 20 μ wide; in *A. reticulata* the wings (except those along the edges of the pyramid) are thick and narrow and inclose an irregular reticulum with smaller meshes, mostly 8 to 12 μ wide. The margins of the wings and ridges are marked by very irregular fine lines which tend to run parallel around the meshes but often deviate from one another and leave minute spaces or interstices of varying sizes. It has already been pointed out that the wings and ridges in *A. elegans* show a tendency to broaden out on their edges, but the condition is even more striking in the new species. In addition to the differences derived from the spores, the female receptacle of *A. reticulata* is covered over with shorter tubercles than that of *A. elegans*, approaching in this respect the Mexican *A. lateralis*.

The inflorescence of the new species has not been determined with certainty. The two male inflorescences observed were borne on elongated branches but, although female receptacles were present in the vicinity, it was impossible to demonstrate a connection between them. If the species could be proved dioicous, this would afford another important character, helping to distinguish it from *A. elegans*; it is more probable, however, that the species is autoicous and that the male inflorescences become difficult to detect by the time the capsules are mature.

Aside from the differences already noted, *A. reticulata* and *A. elegans* are strikingly alike. In general appearance, in the minute structure of the thallus, in the form of the ventral scales and their appendages, in the male inflorescence, in the pseudoperianths, and in the elaters no differences of any significance have been detected. The new species, to be sure, presents a somewhat xerophytic appearance, the margins of the thallus tending to be incurved when dry, but this feature is too inconstant to be emphasized, since the margins of the thallus in *A. elegans* are sometimes incurved to a slight degree.

14. *Asterella bolanderi* (Austin) Underw.

Fimbriaria bolanderi Austin, Proc. Acad. Phila. 1869: 230. 1869.

Fimbriaria violacea Austin, loc. cit., as a synonym of *F. echinella*; Bull. Torrey Club 3: 17. 1872.

Asterella bolanderi Underw. Bot. Gaz. 20: 61. 1895.

Asterella violacea Underw. loc. cit.

Thallus much like that of *A. lateralis*, green or yellowish green above, the margins and ventral surface usually more or less pigmented with purple, the margins strongly incurved when dry, mostly 1 to 2 cm. long and 2 to 4 mm. wide, rarely forking, almost always with ventral branches and apical innovations, the sexual branches ventral and very short, rarely if ever innovating; epidermis composed of cells with somewhat thickened walls and sometimes with minute trigones, averaging about $40 \times 28 \mu$; pores distinctly elevated, measuring (with their surrounding cells) mostly 110 to 150 μ in length and 70 to 110 μ in width, surrounded usually by 7 or 8 (rarely 6 or 9) radiating series of cells with 3 (sometimes 2 or 4) cells in each series, the radial walls slightly thickened; cells con-

taining oil bodies as in *A. elegans*; green and compact tissues as in *A. lateralis*; ventral scales ovate to broadly ovate or lunulate, deeply pigmented throughout or with hyaline borders and appendages, the slime papillae inconspicuous and usually short-lived; cells containing oil bodies usually 15 to 30, mostly scattered but sometimes in pairs or small groups, tending to be more numerous in the acropetal portion; appendages usually borne singly but sometimes in pairs, slightly or not at all constricted at the base, narrowly lanceolate or subulate, mostly 0.5 to 0.75 mm. long and 0.1 to 0.15 mm. wide, acuminate, entire or vaguely and irregularly crenulate; cells mostly 70 to 80×30 to 40μ ; inflorescence autoicous; male inflorescence borne on a very short, subclavate, scarcely expanded branch, consisting of a vaguely defined median group of about 10 antheridia with short ostioles, marginal paleae wanting (so far as observed); female inflorescence borne on a short and expanded, emarginate or obcordate branch; peduncle more or less pigmented with purple except in the upper part, loosely or densely pilose and with a more persistent apical cluster, mostly 1 to 3 cm. high; disk of receptacle mostly 2.5 to 4 mm. across, covered with very low tubercles or essentially smooth, becoming rugose when dry; lobes mostly 4, short but distinct, extending obliquely downward, the central portion hemispherical to bluntly subconoidal; pseudoperianth white or more or less pigmented with purple, mostly 10 to 12- (or sometimes up to 16 or 18) cleft, with lanceolate divisions connate at the apex; capsule pale brown, circumscissile by an irregular line, the operculum coming off in fragments; spores yellow to brown, mostly 65 to 100 μ in diameter, with wavy wings 8 to 12 μ wide along the edges, the margins of wings a little darker; entire surface of spore minutely and irregularly punctulate but without distinct lines, the spherical face showing in addition a coarse regular reticulum, the meshes mostly 12 to 20 μ across, inclosed by a system of thin ridges similar to the wings, the plane faces with similar reticula; elaters yellow to brown, mostly 160 to 220 μ long and 8 to 12 μ wide, tapering slightly toward the blunt ends, mostly bispiral in the middle and sometimes throughout but usually unispiral at the ends for a variable distance.

On banks, sometimes shaded; known only from California. The following specimens have been examined:

CALIFORNIA: Without definite localities, *Coulter* 841 (N. Y.), 1864-70, *Bolander* (N. Y., U. S., Y.); Ukiah, Mendocino County, *Howe* 794 (N. Y.); Hoods Peak, Sonoma County, *Bioletti* (N. Y.); Howell Mountain, Napa County, *Setchell* (N. Y.); Olema, Marin County, *Jepson* (N. Y., U. S.); Mill Valley, Marin County, *Howe* (C. C. H., N. Y., U. S., Y.; also distributed by Underwood & Cook in Hep. Amer., no. 158, as *Fimbriaria bolanderi*); same locality, *Blasdale* (C. C. H., N. Y.); San Rafael, 1865, *Bolander* (N. Y., Y.; type; also distributed by Austin in Hep. Bor. Amer., no. 136d, as *F. bolanderi*); Auburn, *Bolander* (N. Y., Y.); same locality, *Pulsifer-Ames* (N. Y.); Jackson, Amador County, *Hansen* 1615, 2101, etc. (N. Y.); Middle Fork, Amador County, *Hansen* 1020 (N. Y., U. S.); White Bar, Amador County, *Hansen* (C. C. H.); Antioch, Contra Costa County, *T. S. Brandegee* (C. C. H.); Fruitvale, Alameda County, *Howe* (N. Y.); near Stanford University, *Baker* (C. C. H., N. Y., U. S.; distributed in Pacif. Sl. Bry., no. 629, as *Fimbriaria violacea*); Los Burros Trail, Santa Lucia Mountains, Monterey County, *Eastwood* (N. Y.); Pasadena, *McClatchie* (N. Y.); Twin Oaks, San Diego County, *Koch* (N. Y.). Many of these specimens have already been recorded by Howe under either *A. bolanderi* or *A. violacea* (Mem. Torrey Club 7: 52, 54. 1899).

Austin, in his original description of *F. bolanderi*, emphasized the short ventral branches bearing the male and female inflorescences as one of the distinctive features of the species. According to his statements it shared this

feature with only one other species known to him, the plant which he afterwards described as *F. violacea*. Except for the fact that he assigned three or four spirals to the elaters, his account is clear and accurate, although he naturally paid but little attention to histological details. When he published *F. violacea* three years later he again compared it with *F. bolanderi*, but brought out several differences, among them the following: the larger size; the densely areolate thallus, not margined and with a broadened ventral keel; the thicker and blackish purple peduncle; the larger female receptacle, not umbonate upon drying, usually tricarpaceous, and very long-barbate below; the semipendent pseudoperianths, 12 to 16-cleft and violet. To *F. bolanderi* he had ascribed an indistinctly porous thallus, with a membranous margin; a pale purple peduncle (toward the base); a female receptacle umbonate upon drying; subradiately spreading pseudoperianths, usually 10-cleft and white. He admitted that his specimens of *F. violacea* were immature and of course said nothing about the spores and elaters.

The validity of *Asterella violacea* has been recognized by Underwood, Stephani, and Howe. Underwood's description¹ is largely based on Austin's, and makes no mention of the spores and elaters; these structures are described, however, by Stephani and by Howe, the latter author² giving detailed figures of both *A. violacea* and *A. bolanderi*. In accepting *A. violacea* as a species he notes its occasional approach to *A. bolanderi* but regards it as "usually very distinct," emphasizing "the violet, 12-18-cleft pseudoperianth, the larger more conical ♀ receptacle with less spreading lobes and more abundantly paleaceous-barbate beneath, and the commonly larger spores and elaters." He adds that "the violet coloration sometimes disappears from the pseudoperianth," but that under these circumstances the lobes of the receptacle often show a trace of purple.

Stephani places *F. violacea* and *F. bolanderi* ten numbers apart in his monograph, on account of differences in the ventral scales, *F. violacea* being included in a group with lanceolate appendages and *F. bolanderi* in a group with setaceous appendages. In his detailed descriptions he speaks of the appendages of *F. violacea* as single and narrowly lanceolate; of those of *F. bolanderi* as filiform, 2 cells wide below, and long-setaceous at the apex. As a matter of fact these differences are both vague and inconstant. Stephani's statements about the spores also might seem to imply differences, but this is owing largely to their incompleteness. In *F. violacea* he speaks of the spores as lobate-crested with thin rough crests; in *F. bolanderi*, as having narrow, remotely crenulate wings. One other difference which he indicates was based on a misconception. In *F. violacea* he describes filaments reaching the epidermis in the narrow spaces of the green tissue; in *F. bolanderi* he describes narrow spaces without filaments. Stephani's description of *F. violacea* is drawn from Jepson's specimens, and he notes that the pseudoperianths are not violet but hyaline, a deviation which he regards as unimportant.

The writer has had the privilege of studying a large series of specimens, some labeled *A. bolanderi* and some *A. violacea*, from the herbarium of the New York Botanical Garden and from other collections. Although the differences emphasized by Howe and in part by Austin are often apparent, they are nevertheless, in the writer's opinion, too subject to variation to offer a secure basis for specific separation. The differences in the pseudoperianths, for example, are hardly greater than those shown by *A. tenella*, where the color varies from

¹ Bull. Ill. Lab. Nat. Hist. 2: 41. 1884.

² Mem. Torrey Club 7: pl. 97, 98. 1899.

white to purple and the number of divisions from 8 to 12. With regard to the shape of the female receptacle the difference between "subconoidal" and "subhemispherical" is certainly slight; Stephani, in fact, speaks of the receptacle in *A. violacea* as having an "alte rotundato" center and of that in *A. bolanderi* as being "hemisphaerica," and thus seems to imply an even slighter difference. The difference in the direction of the lobes is sometimes striking but by no means constant. In Howe's plate 98, figure 4, the typical condition of *A. violacea* is seen, the lobes being directed downward rather than outward, but in figures 5 and 6 the lobes spread about as much as in plate 97, figure 7, where a typical receptacle of *A. bolanderi* is depicted. On the whole, these slight differences in color and in shape, as well as in the size of the receptacle, are paralleled by other species and might easily be caused by differences in environment.

The difference in the size of the spores is perhaps deserving of more consideration and is usually accompanied by a difference in the width of the marginal wings. In a series of specimens labeled *A. violacea* the spores measured 80 to 110 μ in diameter, and the wings were 10 to 16 μ or even as much as 20 μ in width; in a series labeled *A. bolanderi*, the spores were mostly 65 to 70 μ (rarely 80 μ) in diameter, and the wings were rarely 12 μ in width. The difference in the width of the elaters was less apparent: in *A. violacea* it was usually 10 to 12 μ , although sometimes only 8 μ ; in *A. bolanderi*, it was mostly 8 to 10 μ . At the same time, it should be emphasized that the spore markings, as shown by Howe's descriptions and figures (*pl. 97, f. 21; pl. 98, f. 13*), are essentially the same, whatever the size of the spores. Even the difference in size of the spores, however, is insufficient to be considered specific, since it is unsupported by other trustworthy characters. An equally great variation in size is found in other species of *Asterella* and also in other genera of the Operculatae. In *Reboulia hemisphaerica*, for example, Schiffner¹ distinguishes a variety *microspora*, in which the spores have a diameter from one-fifth to one-fourth smaller than those of the typical form. Associated with this difference in size he finds a difference in color, the spores of the variety being much paler, and he finds similar variations in color in the spores of *Targionia*, *Grimaldia*, and *Neesiella*. Without attempting to explain these variations in all cases he suggests that a small size and a pale color may sometimes be due to immaturity, and he warns against the practice of placing too much reliance on such deviations from type in the proposal of new species. The writer therefore feels justified in regarding *A. violacea* as a synonym of *A. bolanderi*.

When Howe published *A. lateralis* as a new species he regarded it as an ally of *A. bolanderi*, largely on account of its short ventral sexual branches. In distinguishing it he emphasized the spore differences, the somewhat smaller female receptacle, the 8-cleft pseudoperianth (10 to 12-cleft in *A. bolanderi*), and the shorter and broader elaters. If *A. lateralis* is defined in the broad sense indicated in the present paper, the spore differences are not very striking, the markings being much alike in the two species, except that in *A. lateralis* the wings rarely take part in the formation of the reticula and the meshes tend to be a little larger. The differences in the size of the receptacles is likewise slight, if well-developed specimens are compared. The other differences mentioned by Howe are more significant, and it may be added that the elaters of *A. lateralis* tend to be unispiral for a longer distance than those of *A. bolanderi*. The longer tubercles on the receptacle of *A. lateralis* afford another distinctive feature; in *A. bolanderi* the tubercles are very short or even lacking altogether, the surface appearing smooth. In some respects *A. lateralis* occupies an inter-

¹ Oesterr. Bot. Zeitschr. 58: 228. 1908.

mediate position between *A. bolanderi* and *A. elegans*. Possibly the careful study of these closely related species in the field will bring to light differential characters which the study of preserved material has failed to show.

15. *Asterella versicolor* Evans, sp. nov.

Thallus green above, deeply pigmented with purple on the ventral surface and along the margin, mostly 0.5 to 1 cm. long and 1.5 to 3 mm. wide, more or less concave, especially when dry, the slightly crispate margins often becoming more or less incurved; branching ventral, sometimes by apical innovations, some of the branches growing out into narrow subterete processes with reduced green tissue; keel broad and rounded; epidermis composed of cells with slightly thickened walls and scarcely evident trigones, averaging about $45 \times 30 \mu$; pores somewhat elevated, measuring (with their surrounding cells) mostly 100 to 140μ in length and 70 to 90μ in width, surrounded usually by 6 (rarely 5 or 7) radiating series of cells with 2 or 3 cells in each series, the radial walls slightly thickened; cells with oil bodies as in *A. tenella*, usually forming an irregular row in the lower epidermis near the margin; green tissue compact, the air chambers in 3 or 4 layers, those of the dorsal layer larger than the others but subdivided by crowded vertical supplementary partitions extending nearly or quite to the epidermis except in the vicinity of the pores; compact tissue occupying about two-thirds the thickness of the thallus in the median portion, thinning out rather abruptly on the sides and extending from one-third to one-half the distance to the margin, composed of cells with thickened pitted walls; mycorrhiza abundant (so far as observed); ventral scales ovate, often pigmented throughout but sometimes with paler margins and appendages; cells containing oil bodies mostly 10 to 20, scattered but more abundant in the acropetal portion; marginal slime papillae usually persistent; appendages borne singly or (rarely) in pairs, narrowly subulate, not constricted at the base but usually sharply marked off, mostly 0.4 to 0.6 mm. long and 0.05 to 0.07 mm. wide, entire, acuminate, the cells mostly 60 to 100μ long and 30 to 35μ wide; inflorescence autoicous; male inflorescence (so far as observed) borne on a very short expanded branch, the antheridia forming an irregular median group without marginal paleae, the ostioles distinct; female inflorescence borne on a similar but sometimes more elongate and more expanded branch, the peduncle purple, with scattered slender paleae and a denser apical cluster, mostly 1.5 to 2 cm. long; disk of receptacle mostly 2 to 3 mm. across, mostly green or brownish, covered with short crowded tubercles, the center flattened-hemispherical, normally 4-lobed, the lobes short but distinct, extending obliquely outward, the margin crenate; involucre broad, white to purple, entire or nearly so; pseudo-perianth white to purple, mostly 10 to 12-cleft, the divisions lanceolate, coherent at the apex; capsule reddish brown, circumscissile above the middle by an irregular line; spores purplish black, becoming semiopaque, 110 to 120μ in diameter, with paler, translucent, wavy, and minutely crenulate wings 10 to 12μ wide along the edges, the entire surface (inclusive of the wings) covered over by a fine and very irregular reticulum, the meshes mostly 2 to 8μ in diameter, inclosed by low and more deeply pigmented ridges 2 to 3μ high, the periphery of the faces appearing irregularly roughened in profile view; elaters (especially the spirals) pigmented with purple and sometimes deeply so, variously curved, mostly 220 to 240μ in length and 14 to 16μ in diameter, tapering slightly toward the ends, sometimes unispiral throughout but usually bispiral in the median portion for a variable distance and unispiral at the ends, the spirals sometimes difficult to observe in deeply pigmented elaters.

On rocks; known only from central Mexico. The following specimens have been examined:

JALISCO: West end of the Sierra de San Esteban, near Guadalajara, alt. 1,600 meters, September 28, 1908, *Barnes & Land* 192 (Y.; type).

MORELOS: Near Cuernavaca, October 18, 1908, *Pringle* 10667 (Y.; distributed in Pl. Mex. as *Fimbriaria echinella*).

A wide range in color is found in many species of *Asterella* but is particularly striking in the present species. The upper surface of the thallus is usually green, sometimes with a glaucous cast, but the lower surface with its ventral scales and the peduncles of the female receptacles are deeply pigmented with purple. The greatest variety in color is shown by the receptacles themselves. The upper tuberculate portion seems to be pretty constantly green when young, becoming yellow or brownish when old, but the involucres and pseudoperianths show all gradations from a pure white to a clear reddish purple, the amount of pigmentation varying in both extent and degree, although always less than that of the thallus and peduncles.

The slender branches mentioned in the description are almost as thick as broad, and represent a striking and interesting condition. Apparently an ordinary vegetative thallus grows out directly into a process of this character, the keel becoming strongly rounded, the upper surface concave, and the thin marginal portions very narrow and incurved. The branch thus takes on the appearance of a narrow purple cylinder, the upper surface being more or less completely inclosed. In all probability these branches may be looked upon as a xerophytic adaptation, this idea being supported by the incurved margins of the normal flat thallus under conditions of dryness and by the compactness of the green tissue.

In the structure of the thallus, in the method of branching, and in the restriction of the inflorescences to ventral branches, *A. versicolor* shows a close relationship to *A. elegans*. Even the ventral scales have much in common, although the slime papillae tend to be more persistent in the Mexican species and the appendages are usually smaller. Further resemblances are to be noted in the tuberculate female receptacles, with their short, obliquely spreading lobes, broad and undivided involucres, and pseudoperianths with coherent, lanceolate segments. The most striking differential characters are those derived from the male inflorescences and the spores. In *A. versicolor* the male branch is very short, the antheridia form a small, indefinite group without marginal paleae, and the spores are covered over with a fine and very irregular reticulum. In *A. elegans*, on the other hand, the male branch varies greatly in length, the antheridia are in a larger and more clearly defined group with a fringe of marginal paleae, and the spores, which are usually paler, are covered over with a coarse and usually regular reticulum. The tubercles on the female receptacle are about as long as those of *A. elegans*, averaging perhaps 0.3 mm. in length, and are therefore appreciably shorter than those of *A. echinella*, with which the new species has been confused.

The dark spores and purple elaters of *A. versicolor* have much in common with those of *A. lindenbergiana*, although the relationship between the species is exceedingly remote. Even the spore markings, which consist of a delicate network formed by low anastomosing ridges, are much the same. It is not difficult, however, to detect differences in the spores. The reticulum in *A. versicolor*, for example, is more irregular than that of *A. lindenbergiana*, the meshes showing a wider range of variation in size, and the wings are more conspicuous and distinct, owing largely to the tendency of the outer spore wall to become separated in *A. lindenbergiana*. The spores, moreover, are a trifle larger, and the elaters are usually longer.

DOUBTFUL SPECIES.

Five North American species, proposed by Stephani under the generic name *Fimbriaria*, still remain to be considered. Unfortunately the types of these species, which are presumably in the Boissier Herbarium, are inaccessible at the present time; and the published descriptions, even when full, fail to throw light on all their important features. It is therefore impossible to reach definite conclusions regarding their validity, and the writer can do nothing more than call attention to their probable position in the genus. Since, however, Stephani's two new Canadian species, *F. commutata* and *F. macounii*, have had to be reduced to synonymy, being based on variable and insufficient characters, and since many of his descriptions include incorrect or misleading phrases, it is natural to look upon his species and upon his descriptions with a good deal of suspicion, until they have been subjected to critical investigation. The five species were all based, at least in part, on Mexican material.

1. *FIMBRIARIA ARSENI* Stephani, Sp. Hep. 6: 11. 1917.

MEXICO: Without definite locality, *Frère Arsène*.

The species described in the sixth volume of Stephani's extensive *Species Hepaticarum* are treated with unusual brevity, important and even essential characters being often omitted. In the present instance nothing is said about the epidermis or the spores, except that the latter were immature in the material studied. The ventral scales are said to be large and deeply bifid, with the laciniae, or appendages, a little shorter than the basal portion, but the shape of the appendages and the peculiarities of their margins and apices are not alluded to. The air chambers are said to be low and "filiferous" and the inflorescence is described as monoicous. The antheridia are stated to be grouped on lateral male branches, and the disk of the female receptacle to be umbonate and 5-lobed, with short rounded lobes. In the case of the pseudoperianth the ovate and somewhat elongated form and the hyaline character are the only features mentioned, the number of divisions present not being stated. This last omission, however, is made by Stephani throughout his treatment of the genus.

Without studying the actual type material it would be quite impossible to determine specimens from this brief and vague description or to decide the taxonomic status of the species. The situation of the antheridia on lateral branches might perhaps indicate a relationship with *A. elegans*, and a guess might be hazarded that *F. arsenii* was a synonym of *A. lateralis*. Unfortunately it would be nothing more than a guess, since *A. lateralis* is distinguished from its allies largely by its spore characters.

2. *FIMBRIARIA ATRISPORA* Stephani, Bull. Herb. Boiss. 7: 93. 1899.

MEXICO: Without definite localities, *Schaffner, Maury*.

The most important characters assigned to the present species are the following: ventral floral branches; narrow air chambers without "filaments"; large epidermal pores, each surrounded by 6 radiating series of cells with 4 or 5 cells in a series; large purple ventral scales, each bearing 1 or 2 long, lanceolate appendages, often ending in long-linear apices (2 cells wide); a monoicous inflorescence; a very small androecium, the number of antheridia

often reduced to two; a slender peduncle with narrowly linear paleae in the upper part; a disciform receptacle, coarsely tuberculate and scarcely convex, the lobes confluent throughout, the receptacle thus appearing without lobes; an involucre extending to the margin of the disk; an ovate, hyaline, horizontal pseudoperianth, scarcely extending beyond the disk; almost black spores, $108\ \mu$ in diameter, with narrow rough wings; bispiral elaters, $230\ \mu$ long.

Although nothing is said in the description about the length of the sexual branches, the fact that they are ventral in position would seem to indicate that this species, as well as the preceding, was related to *A. elegans*. In fact, the vegetative characters of *F. atrispora* agree in all essential respects with those of *A. lateralis*, except that the air chambers are said to be without "filaments." If this means that no supplementary partitions are present, it might indicate a relationship with the *A. tenella* group, where the dorsal chambers remain undivided; but the phrase by no means demands this interpretation and may simply mean that the supplementary partitions extend to the epidermis and do not look like free filaments in section view. Unfortunately the characters assigned to the female receptacle—the almost flat and scarcely lobed disk—would seem to remove the species definitely from *A. lateralis*. These characters, however, may be due to a poor development of the female plants. In *A. elegans*, for example, the lobes are often indistinct, even when ripe capsules are present, if the conditions have been unfavorable for full development; and the upper surface is not necessarily very convex, if the tubercles are left out of consideration. The writer would therefore suggest that *F. atrispora* be considered a possible synonym of *A. lateralis*, until its status can be adequately determined.

3. FIMBRIARIA MEXICANA Stephani, Sp. Hep. 6: 15. 1917.

MEXICO: Without definite locality, *Frère Nicolás*.

The description of *F. mexicana* is open to the same criticism as that of *F. arsenii* and leaves the reader in much doubt regarding the essential features of the species. Here again the epidermis and the spores are completely neglected, and nothing is said about the air chambers except that the compact ventral tissue (costa) is much thicker than the green tissue (stratum anticum). In fact, the measurements given for thickness lead to curious deductions. According to these the thickness of the ventral tissue in the middle is 1 mm. while the entire thickness of the thallus in the same position is likewise 1 mm., thus leaving nothing at all for the green tissue and the epidermis. The thallus of *F. mexicana* is described as large, 2.5 cm. long and 10 mm. wide, and the ventral scales are said to be large and purple, each with a single unusually large appendage, measuring 3×3 mm., the apex being obtuse and the margin irregularly repand. The branches are stated to be lateral, rarely appearing as apical innovations, and the inflorescence is given as monoicous, with the antheridia borne on slender branches. The more important features associated with the female receptacle are the very large disk, measuring 10 mm. in width, with a minutely umbonate apex and 4 lobes; an obovate involucre, with a papulose cuticle; and an ovate pseudoperianth, equaling the involucre in length.

In its large size *F. mexicana* is comparable with *A. californica* and *A. rugosa*, but the description gives little evidence of relationship with these species, in both of which a dichotomous type of branching prevails. Among the North American species characterized by a prevailing ventral branching, *A. elegans* and its allies at once come to mind. In these species, however, with rare exceptions, neither the thallus nor the disk of the female receptacle exceeds 5 mm. in width. The remarkable appendages of *F. mexicana* also, with their obtuse apices, are very different from anything in the *A. elegans* group, and in their

unusual size they seem to be unique. In all the other North American species the length of the appendages apparently never exceeds 1 mm., and such a length seems to be always associated with narrow and sharp-pointed appendages. The true relationships of *F. mexicana* thus remain obscure.

4. *FIMBRIARIA PRINGLEI* Stephani, Rev. Bryol. 36: 139. 1909.

MEXICO: Without definite locality, *C. G. Pringle*.

Most of the important collections of Hepaticae made by Pringle in Mexico were sent to Stephani for determination, and *F. pringlei* is one of the nine new species which he proposed in his first report on the material.¹ Now the name *F. pringlei* is untenable on account of the older *F. pringlei* Stephani, of 1899, based on *Asterella pringlei* Underw., of 1895, a species discussed at length in the present report. There is also evidence that Stephani himself had little confidence in the validity of this new species, since he makes no allusion to it in the sixth volume of his Species Hepaticarum, where several of the other novelties in Pringle's collection are again proposed as new. Under the circumstances further comment is perhaps unnecessary. Stephani refers to the species, however, certain sterile plants in which the thallus is slender and decurved, appearing hornlike on account of the incurved margins; and since these features are very unusual in *Asterella*, a few words about them may not be out of place. Among the North American species studied by the writer the only one showing branches of this type is *A. versicolor*. Specimens of this species from the Pringle collection, referred by Stephani to *A. echinella*, are in the writer's possession and arouse a strong suspicion that *F. pringlei* Stephani 1909, is a synonym of *A. versicolor*. Unfortunately Stephani describes the spores as yellow and 54 μ in diameter, while those of *A. versicolor* are purplish black and 110 to 120 μ in diameter. It is quite possible, however, that he did have this species before him when he drew up his description, and that his account of the spores was drawn from poorly developed capsules or from the capsules of some other species in accidental admixture.

5. *FIMBRIARIA STAHLII* Stephani, Bull. Herb. Boiss. 7: 201. 1899.

MEXICO: Without definite locality, *Bourgeau, Stahl*.

GUATEMALA: Without definite locality, *Bernouilli*.

Stahl's specimens should, of course, be considered the type. Whether the species is identical with the Mexican "*Fimbriaria stahliana*," investigated by Kamerling² in 1897, does not appear. Kamerling's observations, however, refer simply to the epidermal pores of the female receptacle, so that his account can not be regarded as the publication of a species in the taxonomic sense.

In Stephani's monograph *F. stahlII* directly precedes *F. lateralis*, but the characters which he emphasizes by no means indicate a close relationship. In his description of the thallus he speaks of thin-walled epidermal cells; of narrow air chambers, the roof of nearly every one occupied by an almost bullate pore, the opening surrounded by 6 radiating series of cells with 4 or 5 cells in each series; and of large ventral scales, each with a single long-linear appendage. He doubtfully assigns a monocious inflorescence to the species, and states that the antheridia are in elongated groups on narrow branches. He notes further that the peduncle of the female receptacle is naked; that the disk (known only from imperfect examples) is globose and covered over with numerous papilliform

¹ Hepaticae mexicanae novae recoltées par le Dr. Pringle de Burlington. Rev. Bryol. 36: 138-140. 1909.

² Flora 84: Erg. Bd. 52. pl. 1, 2, f. 14-17. 1897.

pores; that the lobes are delicate, veiny, and spreading; and that the spores are almost black, $85\ \mu$ in diameter, and covered with low crenulate crests.

The undivided air chambers which Stephani emphasizes apparently show that *F. stahlii* is a relative of *A. tenella*, and the long androecia, borne on special branches, point pretty definitely to *A. pringlei*. Unfortunately there are a few marked discrepancies. The epidermal pores, for example, are far more complex than those of *A. pringlei*, where the number of cells in each radiating series is almost invariably two. The appendages, moreover, give no indication of variability, and it would hardly seem possible that the curious marginal teeth so often found in *A. pringlei* could have escaped Stephani's attention, if *F. stahlii* and *A. pringlei* are actually the same. Even if they are not the same, however, they are evidently closely allied.

SCROPHULARIACEAE OF THE CENTRAL ROCKY MOUNTAIN STATES.

By FRANCIS W. PENNELL.

INTRODUCTION.

The purpose of a series of papers, of which this is the first, is to present in summarized form our knowledge of the plants of the family Scrophulariaceae growing within the states of Wyoming, Colorado, and Utah, and in Idaho west to the 113th meridian. Within this area it is planned to consider all species, and to give for each its taxonomic history, its flowering season, and its distribution.

Eastward from these states occur the Black Hills, with a flora akin to that of the foothills of the Rocky Mountains, and southward from them a great expanse of high plains in all respects identical with the high plains of eastern Colorado. To include the former and a large portion of the latter, the area of this study has been extended eastward to the 100th meridian. From this additional territory—western Kansas, western Nebraska, and southwestern South Dakota—comparatively few specimens have been seen, and consequently the specimens here cited do not indicate with the same degree of completeness the distribution of the species. However, eastward the species of this family are few and mostly long known.

Within the large area of this study, an area except for slight irregularities on its northwestern boundaries rectangular in outline, occurs a considerable diversity of natural environment, but a much greater diversity of flora. The lower and vastly the larger portion consists of a flat or rolling tableland, sloping upward from our eastern frontier, the Platte River below North Platte at about 750 meters altitude, to about 2,130 meters altitude on the continental divide in southern Wyoming. Northward, westward, and southward occur various broad valleys and relative depressions. The most important are the valleys of the Powder, Tongue, and Bighorn rivers in northern Wyoming; of the Snake River in southeastern Idaho; the broad basin of the Great Salt Lake, itself about 1,300 meters in altitude, and the deserts westward; the valley of the Virgin River of southwestern Utah, at St. George but 840 meters

above the sea; a large portion of the drainage of the Colorado River and its tributaries, the Green, the Grand, and the San Juan; and the valley of the Rio Grande in southern Colorado. This whole area impresses the traveler by its apparent botanical uniformity. It is throughout a country naturally arid; the gray dull growth of the sagebrush (*Artemisia*) is over the higher land, varied in the lowland with the somewhat livelier hues of the greasewood (*Sarcobatus*). Between the scattered plants bare earth is always visible, for sagebrush can not be said to "cover" or "clothe" the ground, nor does the greasewood hide the whiteness of the alkali in which it grows. Westward and southwestward the aridity increases; through much of central and southern and over enormous areas of western Utah the land is even without sagebrush—a desert almost or quite devoid of vegetation.

Through a land seemingly so uniform one would expect a uniform flora, but in *Penstemon*, the genus with which my studies have made me most familiar, precisely the opposite is the case. The high plains of the east have their distinctive species; others enter the valleys of northern Wyoming from the plains of Montana; different species occur on the "Red Desert," the valley of the Green River in southwestern Wyoming; in the North or Middle Park of northern Colorado; in the Grand or the Gunnison valleys of western Colorado; in the San Juan and Dolores valleys of southwestern Colorado; in the western drainage of the Colorado River from the base of the Uintas southward to northern Arizona; in the valley of the Virgin; in the Salt Lake Valley; and through the valley of the Snake River. No species of the lowland occurs over more than two or three of these regions. Ill-defined divisions within larger areas may be noted, as the valley of the Arkansas River from Pueblo to Las Animas counties, Colorado, and the valley of the Duchesne River in northeastern Utah. Evidently the factor controlling the development of species has been not diversity of valleys one from another, but simply the geographic isolation of each.

Throughout this dry country permanent watercourses are few, and their isolation when upon different river systems would seem far greater than that of the upland plains. Yet the few aquatic or wetland Scrophulariaceae are wide-ranging species, and occur in streams draining to the Atlantic and to the Pacific. Such are several species of *Mimulus* and *Veronica*. Doubtless the explanation of this seeming anomaly is that these species owe their distribution to the transporting agency of birds.

The surface of this plateau was summarized as level or rolling, and such also are the geologic strata; but eastward, and much more so westward, this surface is broken by steep escarpments, buttes, and bluffs which mark the edge of geologic formations, many of them

geologic faults. It is also more evident westward that the streams, and temporary washes as well, have cut for themselves deep and precipitous chasms. The greatest of these are along the Colorado River, but in Utah such canyons occur along most of the lowland streams. The flora of the buttes and canyon walls brings down to the plateaus many species of the hills. Low, flat or slightly sloping table-topped ridges, whose steeper slopes are conspicuously covered by junipers, occur over much of this area, and many of the species which geographically are ascribed to certain valley plains grow only upon these "mesas."

From central Colorado, or in fact from central northern New Mexico, northward and westward, the basal plateau is broken by many mountain chains. All these are more or less isolated. Some are low ridges scarcely to be distinguished from the mesas except by their sharper contour, but some are among the highest mountains of the continent, having about their bases masses of foothills which themselves resemble mountains. From the viewpoint of plant distribution these mountains and the highlands about them may be grouped in three associations:

1. *Northern Rockies*.—These enter our region from the northwest and include all ranges north of the great "saddle" valley plateau of southern Wyoming. They include the ranges about Yellowstone Park, the Teton and Wind River ranges, and the outlying Bighorn Mountains.

2. *Southern or Colorado Rockies*.—These include all the intricate chains of mountains of Colorado, extending northward into the Medicine Bow Range of southeastern Wyoming, and including the outlying La Sal and Abajo mountains of southeastern Utah.

3. *Wasatch or Utah Rockies*.—These extend from the Bear River Range of southeastern Idaho southward across central Utah to the southwestern extremity of that State. Adjoining or somewhat outlying these to the east are the Uinta Mountains, extending to the Colorado line across northeastern Utah, and, farther south, the Henry Mountains. Dr. Rydberg includes the Wasatch in the Southern Rockies, but at least the *Penstemon* flora of each group is quite distinct.

While each of these mountain groups has its peculiar species, the parallelism of the vegetation upon each is most striking. This parallelism is dependent upon altitude, and much has been written concerning the zones of vegetation or life zones which may be recognized. From the sagebrush semidesert at the base one ascends to a scattered low growth of junipers and pinyons; then to a "chaparral" of shrubby, gnarled oaks; then to an open belt of conifers, largely of *Pinus scopulorum*; then to a denser forest of other pines and *Pseudotsuga*, with open groves of *Populus tremuloides*, the

quaking aspen; next to a belt of spruce and fir; then out above the few stunted, highest growing individuals of these to the open alpine meadows and slopes. In this progress, corresponding to increased altitude, there is increased moisture. The alpine meadows are continually moist from more or less permanent snowdrifts, while here and lower on the slopes frequent showers occur in summer.

The foothills exist as a particularly wide and definite zone to the east of the Southern Rockies, and a peculiar flora of foothill species extends from Las Animas County, Colorado, to Albany County, Wyoming. The Black Hills of South Dakota are essentially a foothill region. Ranges of foothills, with a characteristic flora, running through southwestern Wyoming, southeastern Idaho, and northern Utah, connect the Northern with the Wasatch Rockies. In Utah and western Colorado many of the ranges are equivalent to the mountain foothills. In their flora the low mountains, the foothills, and the lower slopes of the main mountain chains are identical.

The different zonal treatments of the life of the Central Rocky Mountain States are based primarily upon the account and the classic map of Dr. C. Hart Merriam,¹ a map of the United States which, however, shows but little detail for this region. The work which Dr. Merriam then roughly outlined has, under his direction or stimulus, since been carried out in greater detail and made far more satisfactory by the United States Biological Survey. A series of state biological surveys has been begun, and for our area that for Colorado,² by Merritt Cary, was published in 1911, and that for Wyoming,³ by the same author, in 1917. These contain excellent maps and interesting and pertinent text. His discussion is based upon personal field study, including practically every portion of these states and botanical even more than zoological evidence. The maps, slightly modified, as explained below, have been my best guide in expressing the zonal distribution of species.

In the plant distribution of the area covered by my study, Dr. Rydberg has been especially interested. In the Bulletin of the Torrey Botanical Club he is publishing a series of sketches of Rocky Mountain vegetation, zone by zone; but the paper which logically introduces these sketches and gives the author's delimitation of each zone is one published in the Memoirs of the New York Botanical Garden.⁴ I am greatly indebted to this outline and to an unpublished

¹ Life zones and crop zones of the United States, by C. Hart Merriam. U. S. Dept. Agr. Biol. Surv. Bull. 10. 1898.

² A biological survey of Colorado, by Merritt Cary. U. S. Dept. Agr. N. Amer. Fauna 33. 1911.

³ Life zone investigations in Wyoming, by Merritt Cary. U. S. Dept. Agr. N. Amer. Fauna 42. 1917.

⁴ 6: 477-499. 1916.

map by the same author. The map covers the entire area of my study, but it is not based upon so full a field acquaintance and does not attempt the detailed zonal delineation which makes Cary's map so valuable. However, in general terminology and broad limitation of zones I have followed it.

The terminology used by Rydberg is in accord with that used abroad, and its names have more appropriateness than have those of Merriam, followed by Cary. A third nomenclature has been evolved by Mr. Marcus E. Jones in his studies of Utah vegetation. Apparently, Jones has reached the same conclusions as to the belts of vegetation to be recognized, so that his names may be correlated readily with those in current use. The three systems of zonal nomenclature are:

RYDBERG.	MERRIAM.	JONES.
Lower Sonoran.	Lower Sonoran.	Tropical.
Upper Sonoran.	Upper Sonoran.	Lower Temperate.
Submontane (Subboreal). ¹	Transition.	Middle Temperate.
Montane.	Canadian }	
Subalpine.	Hudsonian. }	Upper Temperate.
Alpine.	Alpine-Arctic.	Alpine.

The main point of divergence in which I follow Rydberg and not Merriam is in carrying the northern boundary of the Upper Sonoran Zone eastward and northeastward across the high plains following the divide between the Arkansas and Kansas river systems to the south, and the Platte drainage to the north. In the plains any zonal limit must be broad and more or less vague, but it certainly seems to accord better with *Penstemon* distribution to recognize from this line northward an area of Subboreal plains than it does to commence such an area in Montana. Slighter divergence from Cary's maps is in considering the Arkansas Valley above the Royal Gorge to be wholly Submontane (or Transition), with only some Upper Sonoran intrusion—at Salida I found only foothill *Penstemons*. The same treatment applies to the isolated Upper Sonoran areas or, as I view them, local Upper Sonoran intrusions into the Submontane Zone, above the canyon of the Grand River.

Of botanical collections made within this total area there have been many, and yet, such is the diversity of the flora that with collections much more ample than those of many areas of the same size eastward, our knowledge of the flora is still much less complete. The best known sections are the foothills of eastern Colorado, especially those easily reached from Denver, Boulder, Fort Collins, or Colorado

¹ "Subboreal" applies to the Great Plains, "Submontane" to the mountains and intermontane plateaus.

Springs, and the more or less immediate vicinity of Laramie, Wyoming, and of Salt Lake City, Utah, and Yellowstone Park.

At some time, from the early expeditions of James, Nuttall, and Frémont, to the present day of resident collectors, Osterhout, Ramaley, Nelson, Jones, and Garrett, nearly every natural region of this area has been visited by botanists. But most of the land is still practically unsettled, much is reached only with great difficulty, since railroad lines are far apart and mostly away from the mountains, and many sections have been visited but once or twice, and that at only one season of the year, so that even to-day, in spite of a century of collecting, it is evident that a great amount of further exploration needs to be done. The truth of this will appear after noting in the following revision the number of species which have been collected but once, but for which it is quite feasible to predict a natural range. Such is *Penstemon paysonii* of the Dolores Valley.

My own field work, of which primarily this revision is the outgrowth, was undertaken in the summer of 1915. The itinerary of the trip, listing only places for collecting, follows:

June 5-7. Pueblo, Pueblo County, Colorado.

8. North Cheyenne Canyon, El Paso County, Colorado.
9. Manitou, Garden of the Gods, El Paso County, Colorado.
10. Nob Hill, South Cheyenne Canyon, North Cheyenne Canyon, Bear Creek Canyon, El Paso County, Colorado.
- 11, 12. Palmer Lake, El Paso County, Colorado.
12. Aurora, Denver County, Colorado.
13. Golden, Morrison, Jefferson County, Colorado; Valverde, Denver County, Colorado.
14. Boulder, Marshall, Boulder County, Colorado.
15. Denver, Valverde, Denver County, Colorado.
- 16, 17. Windsor, Weld County, Colorado.
17. Horsetooth Mountain, Larimer County, Colorado.
18. Fort Collins, Owl Canyon, Larimer County, Colorado.
20. Laramie, Albany County, Wyoming.
21. Rawlins, Carbon County, Wyoming.
22. Wamsutter, Sweetwater County, Wyoming.
23. Point of Rocks, Sweetwater County, Wyoming.
24. Green River, Sweetwater County, Wyoming.
- 24, 26. Evanston, Uinta County, Wyoming.
- 26, 27. Echo, Summit County, Utah.
- 27, 28. Devils Slide, Morgan County, Utah.
29. Parleys Canyon, Salt Lake County, Utah.
30. Salt Lake City, Becks Hot Springs, Salt Lake County, Utah.

July 1. South Fork of Big Cottonwood Creek, Salt Lake County, Utah.

2. Emigration Canyon, Salt Lake County, Utah.
3. Along Madison River, along Gibbon River, Yellowstone National Park, Wyoming.
- 3, 4. Upper Geyser Basin, Yellowstone National Park, Wyoming.
5. West Thumb and near mouth of Yellowstone Lake, Yellowstone National Park, Wyoming.
6. Yellowstone Canyon, Hedges Peak, Yellowstone National Park, Wyoming.
7. Mammoth Hot Springs, Golden Gate, Swan Lake, Yellowstone National Park, Wyoming.
8. Near Gibbon Falls, Yellowstone National Park, Wyoming.
9. Ashton, Fremont County, Idaho.
- 10, 11. Pocatello, Bannock County, Idaho.
12. Big Cottonwood Canyon, Salt Lake County, Utah.
- 13-15. Silver Lake, Salt Lake County, Utah.
14. Little Cottonwood Canyon, Salt Lake County, Utah.
- 16, 17. Near mouth of Provo Canyon, Utah County, Utah.
17. Rock Canyon, Slide Canyon, Soldier Summit, Utah County, Utah.
18. Castle Gate, Helper, Price, Carbon County, Utah.
- 19-21. Glenwood Springs, Garfield County, Colorado.
22. Grand Junction, Mesa County, Colorado.
24. Ouray, Ouray County, Colorado.
25. Mount Abram, Ouray County, Colorado.
26. Ouray, Ouray County, Colorado.
27. Along Canyon Creek, along Sneffels Creek, Yankee Boy Basin, Ouray County, Colorado.
28. Along Horsethief Trail, east of Ouray, Ouray County, Colorado.
- 29, 30. Cimarron, Montrose County, Colorado.
- 30, 31. Sapinero, Gunnison County, Colorado.
31. Gunnison, Gunnison County, Colorado.

August 1. Near Gunnison River, west of Gunnison, Gunnison County, Colorado.

- 1, 2. Sargents, Saguache County, Colorado.
3. Salida, Chaffee County, Colorado; Canon City, Fremont County, Colorado.
4. Pueblo, Pueblo County, Colorado; Garden of the Gods, El Paso County, Colorado.
5. Pikes Peak, El Paso County, Colorado.

August 6. North Cheyenne Canyon, South Cheyenne Canyon, El Paso County, Colorado.

7. Near switch west of Arena, Jefferson County, Colorado.

8-10. Tolland, Gilpin County, Colorado.

11. Golden, Jefferson County, Colorado.

12. Valverde, Denver County, Colorado.

13, 14. Windsor, Weld County, Colorado.

17. Julesburg, Sedgwick County, Colorado; Ogallala, Keith County, Nebraska.

18. North Platte, Lincoln County, Nebraska.

To Prof. Ellsworth Bethel, of Denver, Colorado, with whom I collected June 13 to 15, to Mr. G. E. Osterhout, of Windsor, Colorado, with whom I collected June 16 to 18, July 20 to 28, and August 13 and 14, and to Prof. A. O. Garrett of Salt Lake City, Utah, with whom I collected June 29 to July 1, and July 12 to 15, I am under obligations for scientific assistance and unstinting hospitality.

Of all species of Scrophulariaceae seen collections were made, these at as many localities as possible. Duplicates were freely included and these have been distributed to leading herbaria. Descriptions of fresh flowers were made and field notes taken of other features. It would be difficult to overestimate the value of such records.

Since my return from the Rockies in August, 1915, much time has been devoted to the study of these Scrophulariaceae. At first I planned to consider little more than the species of the route traversed, extending my study to the northern limit now adopted, but definitely excluding the species of the southern tier of counties in Colorado and of southern and southwestern Utah. This southern country includes many species possessed in common with the northern portions of New Mexico and Arizona, and many or most of these do not reach the main line of the Denver & Rio Grande Railroad, along which I collected. But certain causes have led to the inclusion of these.

Rydberg's Flora of the Rocky Mountains, recently published, includes all species to the southern boundary of Colorado and Utah, and he had desired me to extend the range of this study to the same limit. Also, in asking from herbaria the loan of specimens, exclusive of southernmost Colorado and southern and western Utah, I have received in all cases full representation from these entire states. It has seemed appropriate, in view of the courtesy extended and the opportunity thus afforded, to make full use of these specimens. The study of this additional material has delayed the present report, but the chance to review the rich collections of Jones, Ward, Brandegee, and many others has made the delay worth while.

Specimens have been seen from most of our leading herbaria. The herbaria in which a given collection is to be found are indicated by the following letters:

- A. Academy of Natural Sciences, Philadelphia.
- B. University of Colorado.
- D. State Museum, Denver, Colorado.
- E. Brooklyn Botanic Garden.
- F. Field Museum of Natural History.
- H. Gray Herbarium.¹
- K. Royal Botanic Garden,¹ Kew, England.
- M. Missouri Botanical Garden.
- P. University of Pennsylvania.
- R. Rocky Mountain Herbarium, University of Wyoming.
- S. Stanford University.¹
- U. United States National Herbarium.
- Y. New York Botanical Garden.
- Z. New York State Museum.

To the custodians who have generously aided by lending material, I am much indebted.

Also, I have seen the herbarium of Prof. A. O. Garrett and the large herbarium of Mr. George E. Osterhout. The latter is of special value for the Colorado species. While I have not as yet seen the collection at the Gray Herbarium, through the kindness of Mr. J. Francis Macbride I have verified all types there. The type of *Penstemon petiolatus* T. S. Brandeg., at the University of California, has been critically examined at my request by Dr. H. M. Hall, formerly of that institution.

In the following account, keys to species are included and descriptions are provided for all species considered new. So far as possible all types have been verified. Full synonymy is given, but only for names of the area considered. The paragraph concerning distribution is primarily so restricted, and includes statements of environment; of altitude followed by that of life zone; of the province or physiographic natural region; of the actual surface distribution; and, in cases where the species occurs beyond the area considered, of its wider range. So far as the facts are known, statements of flowering seasons are made. These are compiled from records accompanying specimens seen, and not accepted from literature. By this process our information, while accurate, is obviously imperfect and will need many additions from future field observation.

Specimens are listed only from the area outlined. Under *Collinsia* and *Scrophularia*, genera with but one species each in our area, none are cited, although to afford a basis for the summary of the range

¹ Herbaria not seen, but to which duplicates of my specimens have been sent.

indicated, counties from which specimens have been seen are stated. Under *Chionophila*, a monotypic genus, no specimens are cited, but for a plant so local it is of interest to know the peaks upon which it occurs. For these genera the numbers of my own collections are given. Under *Penstemon*, a genus of many species and these much confused, it has been thought best fully to cite localities and specimens seen, the latter one to a county. All care has been taken to attribute localities to their proper county, but in this there is necessarily some possibility of error. The county is used as a logical, easily located unit of area. The name of each county is followed by a colon, and throughout county names are in alphabetical sequence.

SYSTEMATIC TREATMENT.

VERBASCUM L.

KEY TO THE SPECIES.

Leaves green, dentate, glabrous, not decurrent; stem (above) and calyx with simple glandular hairs; inflorescence lax; pedicels 10 to 15 mm. long; sepals lanceolate, 5 to 6 mm. long, much shorter than the capsule; corolla 25 to 30 mm. wide, yellow or white; filaments all densely lanose with knobbed purple hairs; capsule 7 to 8 mm. long, glandular-puberulent; seeds dark gray, 0.8 to 0.9 mm. long.

1. *V. blattaria*.

Leaves yellowish green, finely crenate, decurrent; stem, leaves, and calyx densely woolly with stellate-branched nonglandular hairs; inflorescence densely crowded; pedicels very short or none; sepals ovate, 6 to 8 mm. long, slightly shorter than or equaling the capsule; corolla 20 to 22 mm. wide, always yellow; 3 posterior filaments lanose with filiform yellow hairs, the 2 anterior ones glabrous; capsule 6 to 8 mm. long, stellate-pubescent; seeds brownish gray, 0.4 to 0.5 mm. long.....2. *V. thapsus*.

1. *Verbascum blattaria* L.

Fields and roadsides; rare (Boulder, Colorado, *Osterhout* 2462). Introduced from Europe.

2. *Verbascum thapsus* L.

Fields and roadsides; frequent (*Pennell* 5958, 6116). Introduced from Europe.

LINARIA L.

KEY TO THE SPECIES.

Corolla (excluding spur) 15 to 18 mm. long, yellow, the posterior lip arched over the anterior one, the anterior lip forming a conspicuous protruding orange palate, the spur tapering from a broad stout base; capsule 10 mm. long, much exceeding the sepals; style 8 mm. long; seeds 1.7 mm. long, flattened circularly and broadly winged; stem 30 to 100 cm. tall, densely leafy; young stems not prostrate.....1. *L. linaria*.

Corolla (excluding spur) 14 to 17 mm. long, blue, the posterior lip erect, the anterior one broadly spreading but not forming a raised palate, the spur very slender throughout; capsule 2 to 3 mm. long, equaling or slightly exceeding the sepals; style 1 to 1.5 mm. long; seeds 0.3 to 0.4 mm. long, cylindric, obtusely prismatic-angled, not winged; stem slender, 20 to 80 cm. tall, less leafy; young stems prostrate.....2. *L. texana*.

1. *Linaria linaria* (L.) Karst.

Fields and roadsides; rare (Gunnison, Colorado, *Shear* 5074). Introduced from Europe.

2. *Linaria texana* Scheele.

Linaria texana Scheele, *Linnaea* 21: 761. 1848. "Zwischen Houston und Austin (Texas) häufig: Römer." Type not seen or verified, but description evidently of the plant here characterized.

Occasional in sandy fields or along railroads, base of foothills of northeastern Colorado, at altitudes of 1,500 to 1,740 meters; possibly locally introduced; flowering in June.

COLORADO: Boulder: *Penard* 89. Jefferson: Golden, *Pennell* 6386. Larimer: Horsetooth Mountain, *Pennell* 5856.

Closely related to the eastern *L. canadensis* (L.) Dum.-Cours., but mostly distinguishable as follows:

Corolla of early flowers (excluding spur) 7 to 8 mm. long, the spur 2.4 mm. long; sepals linear-lanceolate, acuminate to subulate-tipped; seeds sharply prismatic, the angles thin, the faces smooth to somewhat tuberculate. Apparently native through the eastern Coastal Plain, Massachusetts to Florida and eastern Texas; Illinois, and likely introduced elsewhere northward and inland.

L. canadensis.

Corolla of early flowers (excluding spur) 14 to 17 mm. long, the spur 5 to 9 mm. long; sepals lanceolate to ovate-lanceolate, obtusish to acute; seeds not sharply prismatic, the angles more or less rounded, the angles and faces densely tuberculate. From South Carolina, southwestern Missouri, Colorado, and Vancouver Island southward, within the tropics through the Cordilleras and Andes to Argentina and Chile. (*L. subandina* Diels is evidently a synonym. From Florida to Texas, and perhaps elsewhere, intermediates with *L. canadensis* occur.) *L. texana*.

COLLINSIA Nutt.

1. *Collinsia parviflora* Lindl.

Collinsia parviflora Lindl. Bot. Reg. 13: pl. 1082. 1827. "Received by the Horticultural Society from Mr. David Douglas, in 1827, by whom it was found in the vicinity of the River Columbia." In account of *C. grandiflora* Lindl. (op. cit., pl. 1107), "We learn from [Mr. Douglas] that the species published at folio 1082 of the present volume is confined to the rocks in the vicinity of the ocean." Type station evidently near the mouth of the Columbia, probably near Fort Vancouver, Washington. Specimen in herbarium of Columbia University, New York Botanical Garden, labeled "N. West. Amer.," received by Torrey from Lindley, if not actually an isotype,¹ is certainly authentic.

Moist or dry, shady or open, loamy soil, gravelly or rocky, on banks and hillsides, at altitudes of (1,350) 1,500 to 2,850 meters; Submontane and Montane zones; flowering from mid-April to late August, depending upon latitude and altitude. Foothills and lower mountain slopes, descending into plateaus along canyon sides and river banks; throughout the area. British Columbia and Keeweenaw County, Michigan, to northern New Mexico and southern California.

SOUTH DAKOTA: Meade County.

¹The word isotype is used to denote specimens of the type collection other than the type itself.

WYOMING: Albany (5875),¹ Carbon, Fremont, Laramie, Lincoln, Sheridan, Uinta (5911), and Weston counties. Yellowstone National Park (5993, 6005, 6017, 6026).

IDAHO: Bannock (6058) and Fremont (6051) counties.

COLORADO: Archuleta, Boulder (5829), Clear Creek, Delta, Denver (5836), Douglas, El Paso (5805, 5812), Fremont, Gilpin, Grand, Gunnison, Huerfano, Jefferson (5818), Larimer (5857), Montezuma, Montrose, and Pueblo counties.

UTAH: Beaver, Box Elder, Cache, Kane, Morgan (5946), Piute, Salt Lake (5981, 5982), Summit (5928, 5938), Utah, Washington, and Weber counties.

SCROPHULARIA L.

1. *Scrophularia occidentalis* (Rydb.) Bicknell.

Scrophularia nodosa occidentalis Rydb. Contr. U. S. Nat. Herb. 3: 517. 1896. "Rapid City [South Dakota], altitude 1,000 m., July 25, [1892, P. A. Rydberg] (No. 914)." Isotype seen in herbarium of New York Botanical Garden.

Scrophularia occidentalis Bicknell, Bull. Torrey Club 23: 315. 1896.

Moist soil, loam or sand, frequently gravelly or rocky, woodland, especially thickets along streams, more rarely in open, at altitudes of 1,350 to 2,700 (3,000) meters; Submontane (Subboreal) and Montane zones; flowering from early June to middle of August, depending upon latitude and altitude. Foothills and lower mountain slopes, descending into plateaus along canyon sides and river banks; throughout the area. A widespread species, apparently not distinct from *S. leporella* Bicknell of the Atlantic states.

SOUTH DAKOTA: Fall River and Pennington counties.

IDAHO: Bannock (6057) and Fremont (6047) counties.

COLORADO: Boulder (5832), Clear Creek, Denver (5837, 6391), El Paso (5778, 5783, 5809, 5815, 6336), Garfield (6161, 6171), Grand, Gunnison (6278, 6279), Huerfano, Jefferson (5819, 5824, 6388), La Plata, Larimer (5852, 5866), Montrose, Routt, Summit, and Weld counties.

UTAH: Box Elder, Cache, Morgan (5942), Salt Lake (5966, 5974, 5983, 6077), San Juan, Utah (6117, 6122, 6128), and Weber counties.

CHIONOPHILA Benth.

1. *Chionophila jamesii* Benth.

Chionophila jamesii Benth. in DC. Prodr. 10: 331. 1846. "In montibus Scopulosis Americae borealis juxta nives perpetuas (James!) * * * (v. in herb. Torrey et Hook.)." Isotype seen in herbarium of New York Botanical Garden, doubtless from Pikes Peak.

Moist, gravelly slopes, above timber line, at altitudes of 3,600 to 4,200 meters; Alpine Zone; flowering from early July to late August. High mountains, Medicine Bow Mountains of southeastern Wyoming, southward through the Front Range of northeastern Colorado; on Pikes Peak; on the San Juan and Uncompahgre mountains of southwestern Colorado; doubtless through intervening ranges.

WYOMING: Albany: Medicine Bow Mountains.

COLORADO: Boulder: Arapahoe Peak; Longs Peak. Clear Creek: Berthoud Pass; Douglass Mountain; Grays Peak; Mount Flora; Mount Lincoln. El Paso: Pikes Peak (6330, 6335). Jackson: Ethel Peak. Larimer: Mountains above Beaver Creek; Estes Park; Longs Peak. Mineral: Near Pagosa Peak. Ouray: Mount Hayden. San Juan: Red Mountain. Summit: Mount Bartlett. County uncertain: Sawatch Range; Sierra Sangre de Cristo.

¹ In *Collinsia*, *Scrophularia*, and *Chionophila* numbers refer to specimens of my own collecting.

PENSTEMON [Mitchell] Schmidel.¹

KEY TO SECTIONS.

Anther sacs opening from the distal apex, throughout or partially; seeds grayish brown or brown, deepening to blackish, minutely or obsoletely reticulate.

Corolla scarlet, somewhat fleshy, the throat tubular. **ELMIGERA** (Reichenb.) Benth.

Corolla 25 to 30 mm. long, the posterior lobes 5 mm. long, united one-half their length, the anterior lobes scarcely spreading; anther sacs 2 mm. long, lanceolate, minutely puberulent, slightly united at base; seeds 2.5 mm. long, less sharply angled; leaves at base of stem obovate, those on the stem ovate, the upper ones rounded at base, the opposite leaves completely clasping the stem; thyrsus strict, the peduncles and pedicels short. **I. Centhranthifolii.**

Corolla 30 to 35 mm. long, the posterior lobes 8 to 12 mm. long, united two-thirds to three-fourths their length, the anterior lobes decurved-reflexed; anther sacs 1.5 to 2 mm. long, triangular-ovate, scarcely puberulent, broadly united at base; seeds 2 to 2.2 mm. long, sharply angled; leaves at base of stem lanceolate-oblong, those on the stem linear to lanceolate, narrowed at base and slightly clasping, the opposite leaves not meeting; thyrsus lax, the peduncles and pedicels longer. **II. Barbati.**

Corolla dull red, blue, purplish blue, or white, membranous, the throat usually wider.

Anther sacs glabrous to lanate; seeds merely angled; corolla throat terete or anteriorly flattened and ridged within. Inflorescence thyrsoid, rarely seeming racemose; leaves thin to succulent, not coriaceous; plants herbaceous to suffrutescent at base. **EUPENSTEMON** Benth.

Corolla throat rounded anteriorly; seeds brown, 1.5 to 5 mm. long; stems erect from base, not suffrutescent; plants probably biennial.

Corolla glandular-puberulent within, white or red.

Corolla red, the throat narrow; sterile filament glabrous; leaves entire; plants glabrous, glaucous. **III. Utahenses.**

Corolla white, the throat broad; sterile filament bearded; leaves frequently dentate; plants rough-puberulent, not glaucous. **IV. Albidi.**

Corolla not glandular-puberulent within, blue or purplish blue (except in *Spectabiles* and *Petiolati*).

Leaves broadly linear to orbicular.

Corolla throat nearly tubular, the posterior lobes united but slightly at base, the corolla scarcely 2-lipped. Plants cinereous-puberulent; corolla glabrous within. **V. Fremontiani.**

Corolla throat evidently inflated anteriorly, the posterior lobes united at least one-fourth their length, the corolla evidently 2-lipped.

Leaves relatively thin, not fleshy; plants scarcely or not glaucous (except in *Spectabiles* and *Petiolati*); sterile filament relatively slender, scarcely or but slightly enlarged distally; seeds 1.5 to 3.5 mm. long, finely and closely reticulate; posterior corolla lobes more arched, usually but slightly spreading.

Plants more or less densely puberulent or pubescent; corolla mostly purplish, the posterior lobes mostly less united, always for less than one-half their length; anther sacs always glabrous, the line of contact between the sacs relatively long. Sterile filament conspicuous, densely bearded with yellow or orange hairs; seeds more evidently reticulate. **VI. Cristati.**

¹ C. C. Schmidel, *Icones Plantarum* 2. 1762. Type, from description and pre-Linnean citation, *Chelone pentstemon* L. This would establish the orthography "*Penstemon*."

Plants glabrous or finely puberulent, rarely decidedly so; corolla mostly blue, the posterior lobes mostly more united, for one-third to usually over one-half their length; anther sacs glabrous to lanose, with short line of contact.

Stem leaves ovate to orbicular, dentate or serrate, glaucous; corolla (probably in ours) not blue.

Corolla 15 mm. long, scarcely inflated, strongly bearded within, apparently reddish; anther sacs short, semicircular; sterile filament not exerted, relatively short-bearded; leaves orbicular, dentate, the lower ones on conspicuous petioles, the upper ones distinct; plants cinereous-puberulent, glandular-pubescent in the inflorescence .. **VII. Petiolati.**

Corolla 25 to 30 mm. long, strongly inflated, slightly bearded within, "cream-white, and usually suffused or particolored with pink"; anther sacs ovate; sterile filament conspicuously exerted, bearded with long hairs; leaves ovate, serrate, the lowest somewhat petioled, the upper ones frequently connate; plants glabrous below, glandular-pubescent in the inflorescence..... **VIII. Spectabiles.**

Stem leaves linear to lance-ovate, entire, not or scarcely glaucous, the upper ones always distinct; corolla blue. Sterile filament bearded with short hairs or glabrous..... **IX. Glabri.**

Leaves relatively thick, more or less fleshy; plants strongly glaucous; sterile filament relatively broad, more or less enlarged distally (bearded with relatively short hairs); seeds 2.5 to 5 mm. long, more coarsely alveolate-reticulate; corolla lobes all widely spreading (posterior lobes united less than one-half their length).

X. Coerulei.

Leaves filiform to narrowly linear.

Corolla 13 to 15 mm. long, the throat straight, inflated anteriorly, pubescent within over bases of the anterior lobes; sterile filament bearded; plants 10 to 30 cm. tall, the leaves more or less crowded at or near the base..... **XI. Laricifolii.**

Corolla 15 to 20 mm. long, the throat decurved, narrow, not inflated, puberulent within over bases of all the lobes; sterile filament glabrous; plants 20 to 40 cm. tall, the leaves more scattered on the stem..... **XII. Ambigui.**

Corolla throat flattened and 2-ridged within anteriorly; seeds grayish brown, 0.5 to 2 mm. long; stems usually depressed and more or less suffrutescent at base; plants probably all perennials.

Corolla white, glandular-puberulent within over bases of all the lobes; leaves coarsely sinuate-dentate..... **XIII. Deusti.**

Corolla blue or chocolate-purple, pubescent to lanose within over bases of the anterior lobes; leaves, at least the basal ones, entire or nearly so.

Corolla 8 to 22 mm. long, pale to deep blue, pubescent within over bases of the anterior lobes, these equaling or somewhat exceeding the posterior ones.

Corolla somewhat expanding, the posterior lobes more or less spreading; seeds pale toward the margin, lighter in shade, 0.5 to 2 mm. long; stems erect, diffuse-spreading only at base, not forming mats; plants finely puberulent or glabrous..... **XIV. Graciles.**

Corolla nearly tubular, the posterior lobes projecting; seeds uniformly dense, very dark, 1.5 to 2 mm. long; stems lower, diffuse-spreading partially or throughout, forming mats; plants more or less puberulent.....**XV. Caespitosi.**

Corolla 25 to 30 mm. long, lavender-blue or chocolate-purple, lanose within over bases of the strongly projecting anterior lobes.

XVI. Whippleani

Anther sacs densely comose; seeds slightly wing-angled; corolla throat strongly flattened anteriorly and ridged within; inflorescence by reduction seemingly racemose; leaves coriaceous; plants shrubby, woody below. *DASANTHERA* (Raf.) Pennell¹.....**XVII. Fruticosi.**

Anther sacs opening partially by short confluent proximal slits, the anthers horse-shoe-shaped; seeds pale gray, minutely honeycombed. Plants shrubby at base; corolla widely inflated, glabrous without and within; sterile filament glabrous. *SACCANTHERA* Benth.

Corolla scarlet-red, the throat nearly tubular, deeply 2-lipped, the posterior lobe projecting, the anterior ones strongly descending-recurved.

XVIII. Bridgesiani.

Corolla violet or blue, the throat inflated, shallowly 2-lipped, the lobes all spreading.

XIX. Heterophylli.

I. CENTRANTHIFOLII.

Stem glabrous; leaves glabrous or nearly so; sepals triangular-ovate, acute to acuminate, 3 to 5 mm. long.....**1. P. eatoni.**

Stem and leaves finely pubescent or puberulent; sepals triangular-ovate to lanceolate, acute or more frequently long-acuminate, 3 to 7 mm. long.

1a. P. eatoni undosus.

II. BARBATI.

Anther sacs not lanate, more spreading; corolla throat relatively broad.

Corolla within the throat glabrous anteriorly or with a few white hairs; sepals mostly 3 to 5 mm. long.....**2. P. torreyi.**

Corolla within throat lanate anteriorly with yellow hairs; sepals mostly 5 to 9 mm. long.

Stem and leaves glabrous; stem leaves linear or nearly so.....**3. P. barbatus.**

Stem and leaves puberulent; stem leaves broader than linear.

3a. P. barbatus puberulus.

Anther sacs more or less lanate, slightly thicker and more erect; corolla throat narrow.

4. P. trichander.

III. UTAHENSES.

A single species.....**5. P. utahensis.**

IV. ALBIDI.

A single species.....**6. P. albidus.**

V. FREMONTIANI.

Plants 40 to 80 cm. tall; basal and lower leaves obovate, emarginate, the upper leaves oblong-ovate; calyx lobes broadly ovate, abruptly short-caudate, with relatively conspicuous, erose, scarious margins; corolla 23 to 25 mm. long; sterile filament nearly or quite glabrous..... **7. P. jonesii.**

¹ *Dasanthera* Raf. Amer. Month. Mag. 2: 267. 1818. Type species, *Gerardia fruticosa* Pursh.

Plants 10 to 30 cm. tall; basal and lower leaves oblanceolate to obovate, acutish, the upper leaves lanceolate; calyx lobes acute to acuminate, with narrow, scarcely erose, scarious margins; corolla 15 to 20 mm. long; sterile filament bearded.

Calyx lobes acute; anther sacs glabrous; sterile filament moderately bearded.

8. *P. leptanthus*.

Calyx lobes acuminate; anther sacs barbate; sterile filament but slightly bearded.

9. *P. fremontii*.

VI. CRISTATI.

Anther sacs opening nearly throughout, the line of contact of the sacs short; basal and lower leaves linear to linear-lanceolate; sterile filament densely bearded throughout with orange-golden hairs; seeds blackish.

Corolla 20 to 25 mm. long, much more than twice exceeding the sepals; stems relatively stout.....10. *P. auriberbis*.

Corolla 12 mm. long, much less than twice exceeding the sepals; stems slender.

11. *P. parviflorus*.

Anther sacs opening throughout, the line of contact of the sacs longer; basal and lower leaves lanceolate to ovate; sterile filament bearded, especially distally, with yellow hairs; seeds brown.

Corolla throat moderately (i. e., less abruptly) inflated, slightly pubescent to glabrous within anteriorly, all the lobes spreading; anther sacs with moderate line of contact; sterile filament bearded with short hairs, rarely slightly exserted.

Inflorescence, stems (throughout), and calyx cinereous-puberulent but not glandular; plants 2 to 10 cm. tall; basal leaves 1.2 to 3 cm. long....12. *P. dolius*.

Inflorescence, stems (above), and calyx glandular-pubescent; plants taller; basal leaves 3 to 6 cm. long.

Basal leaves lanceolate; stem leaves narrowed to a clasping base; corolla 18 to 22 mm. long; anther sacs oblong-lanceolate, with medium line of contact; plants 8 to 16 cm. tall.....13. *P. paysonii*.

Basal leaves ovate; stem leaves cordate-clasping at base; corolla 15 to 17 mm. long; anther sacs ovate, with longer line of contact; plants 10 to 40 cm. tall.....14. *P. moffatti*.

Corolla throat abruptly and strongly inflated, lanose within anteriorly, the posterior lobes arched and projecting forward (not spreading); anther sacs with long line of contact; sterile filament bearded with long hairs, usually exserted.

Corolla throat not contracted distally, the lobes one-fourth to one-third the total length; anther sacs with line of contact nearly equaling the length of each.

Corolla 20 to 35 mm. long, the throat very widely inflated, the lobes one-third the corolla length; basal leaves ovate, rough-puberulent, more or less lanate-pubescent; stem (above) and sepals white-lanate with gland-tipped hairs.

Stem leaves lanceolate, entire or nearly so; corolla 25 to 35 mm. long.

15. *P. eriantherus*.

Stem leaves lanceolate-linear, more or less dentate with salient teeth; corolla 20 to 28 mm. long.....15a. *P. eriantherus saliens*.

Corolla 15 to 20 mm. long, the throat less inflated, the lobes one-fourth the corolla length; basal leaves lanceolate, roughish-puberulent to glabrate; stem (above) and sepals puberulent with gland-tipped hairs.

16. *P. ophianthus*.

Corolla throat obviously contracted distally, the lobes one-fifth the corolla length; anther sacs with line of contact longer than the length of each.

17. *P. cleburnei*.

VII. PETIOLATI.

A single species.....18. *P. petiolatus*.

VIII. SPECTABILES.

A single species.....19. *P. palmeri*.

IX. GLABRI.

Anther sacs glabrous (or in *P. hallii* sometimes with a small tuft of hairs precisely at the summit of the filament).

Anther sacs with relatively long line of contact, opening throughout.

Corolla throat abruptly inflated and decurved at base; sterile filament short-bearded (very rarely glabrous); anther sacs with relatively long line of contact; sepals glandular-puberulent externally, with broad lacerate scarious margin. Plants 5 to 25 cm. tall.....20. *P. hallii*.

Corolla throat gradually much expanded from the base, not abruptly decurved; sterile filament glabrous (very rarely with a few hairs at apex); anther sacs with short line of contact; sepals glabrous externally, with or without a narrow entire scarious margin.

Plants 5 to 10 cm. tall, puberulent; basal leaves 2 to 2.5 cm. long; stem leaves few; thyrsus of 1 or 2 1-flowered fascicles; sepals ovate, not or scarcely scarious-margined; corolla glabrous within.....21. *P. parvus*.

Plants 40 to 90 cm. tall, glabrous; basal leaves 6 to 12 cm. long; stem leaves numerous; thyrsus of many several-flowered fascicles; sepals oblong-ovate, slightly scarious-margined; corolla glabrous or sparsely pubescent within anteriorly.....22. *P. unilateralis*.

Anther sacs scarcely contiguous, the line of contact very short.

Anther sacs opening throughout.

Sepals narrowly ovate, more or less caudate-tipped, conspicuously scarious-margined, glabrous externally; lower stem leaves narrowly oblanceolate, sometimes 12 cm. long.....23. *P. magnus*.

Sepals lanceolate-acuminate, not or obscurely scarious-margined, glandular-puberulent externally; lower stem leaves lanceolate, tapering distally, 4 to 10 cm. long.....24. *P. leiophyllus*.

Anther sacs opening partially.

Plants 40 to 70 cm. tall, glabrous throughout; sepals broadly ovate, more or less abruptly acuminate; corolla glabrous externally, the throat more inflated anteriorly; sterile filament slightly bearded.....25. *P. laevis*.¹

Plants 20 to 35 cm. tall, cinereous-puberulent throughout; sepals ovate-acuminate; corolla glandular-puberulent externally, the throat less inflated anteriorly; sterile filament glabrous.....26. *P. wardii*.

Anther sacs hispid-pubescent to lanate on the sides, scarcely contiguous, the line of contact of the sacs very short.

Anther sacs short-pubescent with relatively stiff hairs.

Anther sacs opening throughout.

Corolla 25 to 30 mm. long, the throat much inflated anteriorly and slightly narrowed to the orifice, the anterior lobes abruptly deflexed-spreading and pubescent or glabrous at base within; sepals not glandular-puberulent externally.

Sepals 2 to 4 mm. long, nearly orbicular, with short acute or no tip; corolla pubescent or glabrous within.....27. *P. glaber*.

Sepals 5 to 7 mm. long, mostly ovate, with more or less prolonged acuminate tip.

¹ For description of a related new species, *Penstemon tidestromii*, omitted in the key, see p. 379.

- Sterile filament relatively slender, scarcely or not lobed at the apex, bearded near the apex with yellow hairs; corolla 23 to 30 (-33) mm. long, usually decidedly pubescent within; sepals with an acuminate tip nearly equaling or exceeding the body; stem glabrous or puberulent28. *P. alpinus*.
- Sterile filament relatively stout, frequently or mostly bilobate at the apex, glabrous (rarely with a few hairs at apex); corolla 30 to 40 mm. long, slightly pubescent or glabrous within; sepals with an acuminate tip shorter than the body; stem puberulent.....29. *P. brandegei*.
- Corolla 15 to 25 (-30) mm. long, the throat inflated anteriorly and not narrowed to the orifice, the anterior lobes spreading and glabrous at the base within; sepals minutely and usually obscurely glandular-puberulent externally.
- Corolla widening from a narrow basal tube; sepals ovate, with acuminate tip; plants 30 to 100 cm. tall.
- Corolla 15 to 22 mm. long, the posterior lobes united less than one-half their length; sepals with a long acuminate tip.....30. *P. saxosorum*.
- Corolla (20-) 22 to 30 mm. long, the posterior lobes united over one-half their length; sepals with a short acuminate tip....31. *P. subglaber*.
- Corolla gradually widening from a broad basal tube; sepals broadly ovate, acute; plants 10 to 20 cm. tall.....32. *P. uintahensis*.
- Anther sacs opening partially.
- Corolla 27 to 30 mm. long, the throat slightly narrowed to the orifice; sepals broadly ovate to orbicular, with broad scarious denticulate margin and short acuminate tip; thyrsus strongly secund; stem leaves lanceolate, narrowed to slightly rounded at the base.....33. *P. cyaneus*.
- Corolla 20 to 30 mm. long, the throat not narrowed to the orifice; sepals lanceolate to ovate, with no or moderate scarious margin, acuminate-attenuate; thyrsus not strongly secund; stem leaves with a broader rounded base.
- Corolla 20 to 25 mm. long; sepals attenuate-tipped, not or scarcely scarious-margined.
- Stem leaves ovate, the largest 2 to 6 cm. wide; stem glabrous throughout or puberulent only near the base; capsules 9 to 12 mm. long.
34. *P. cyananthus*.
- Stem leaves lanceolate, the largest mostly 1 to 1.5 cm. wide; stem more puberulent, frequently so nearly throughout; capsules 8 to 10 mm. long.....34a. *P. cyananthus subglaber*.
- Corolla 25 to 30 mm. long; sepals shorter-tipped, decidedly scarious-margined; stem glabrous or puberulent.....34b. *P. cyananthus longiflorus*.
- Anther sacs lanate with flexuous white hairs.
- Corolla deep blue, the throat obviously exceeding the basal tube; anther sacs less densely lanate; sterile filament more or less bearded (rarely glabrous in *P. strictus*); thyrsus strict, secund; pedicels relatively short; herbage brighter green, rarely glaucous.
- Anther sacs lanate-pubescent with slender hairs, these shorter than or about equaling the width of the sac.
- Anther sacs opening partially; pedicels and sepals somewhat glandular-puberulent.
- Leaves lanceolate, the cauline ones narrowly so, mostly acuminate, the largest 6 to 10 cm. long; sepals with broad scarious margin, acuminate to an attenuate tip; corolla 20 to 30 mm. long.¹

¹ For description of a related new species, *Penstemon mensarum*, omitted in the key, see p. 380.

Sepals 8 to 9 mm. long, the margin finely denticulate distally and with an acuminate-attenuate tip, this nearly or quite equaling the sepal body; corolla 30 mm. long, the posterior lobes projecting; leaves lanceolate, the widest 0.9 to 1.1 cm. wide..35. *P. scariousus*.

Sepals 4 to 6 mm. long, the margin coarsely denticulate distally and with an acuminate tip, this much shorter than the sepal body; corolla 20 mm. long, the posterior lobes apparently more spreading; leaves linear-lanceolate, the widest 0.7 to 0.9 cm. wide.

36. *P. garrettii*.

Leaves ovate to lanceolate, the cauline ones lanceolate, obtuse to acute, the largest ones 3 to 7 cm. long; sepals with obscure narrow scarious margin, acute; corolla 15 to 20 mm. long.....37. *P. cyanocaulis*.

Anther sacs opening throughout; pedicels and sepals glabrous. Corolla 15 mm. long; plant 10 cm. tall.....38. *P. caryi*.

Anther sacs lanate with tortuous hairs, these mostly much exceeding the width of the sac.

Sepals 7 to 10 mm. long, long-acuminate, with broad conspicuous scarious margin, slightly puberulent; corolla more widely expanded.

39. *P. strictiformis*.

Sepals 3 to 5 mm. long, obtuse to acute (or short-acuminate), with narrow scarious margin, glabrous; corolla less widely expanded.

Basal leaves and stem (throughout) nearly or quite glabrous, usually not or but slightly glaucous; leaves mostly lanceolate, those of the stem frequently narrower.....40. *P. strictus*.

Basal leaves and stem (at base or frequently throughout) puberulent, more commonly glaucous; leaves narrower, the basal ones narrowly lanceolate, the cauline ones linear.....40a. *P. strictus angustus*.

Corolla pale blue, the throat scarcely exceeding the relatively long basal tube; anther sacs densely lanate with long hairs; sterile filament glabrous; thyrsus lax, less secund; pedicels relatively long; herbage more glaucous.

41. *P. comarrhenus*.

X. COERULEI.

Stamens and style included; anther sacs explanate.

Corolla 40 to 45 mm. long, glabrous within, the lobes slightly spreading; sterile filament closely short-bearded near the apex; capsule 20 to 25 mm. long, conspicuously acuminate.....42. *P. grandiflorus*.

Corolla 10 to 25 mm. long, the lobes strongly spreading; sterile filament strongly bearded toward the apex; capsule 10 to 15 mm. long, acuminate.

Corolla 15 to 25 mm. long, lanate-pubescent within at base of the anterior lobes lavender-pink to lavender-blue; sterile filament very densely bearded.

Corolla (15-) 20 to 25 mm. long; sterile filament strongly enlarged distally, very densely bearded with golden hairs; stem leaves ovate, the upper ones acuminate, all firm to somewhat fleshy.

Sepals ovate-acuminate; sterile filament bristle-bearded to the apex; basal and stem leaves lanceolate to lance-ovate.

Thyrsus strongly secund, composed of relatively lax fascicles; flowers lavender-pink; leaves firm, very glaucous, scarcely veined.

Corolla 20 to 25 mm. long; stem leaves lanceolate to lance-ovate; plants tall.....43. *P. secundiflorus*.

Corolla 15 to 20 mm. long; stem leaves narrower; plants smaller.

43a. *P. secundiflorus lavendulus*.

Thyrus not secund, composed of close fascicles; flowers bluish; leaves somewhat fleshy, slightly glaucous, evidently reticulate-veined.

44. *P. osterhoutii*.

Sepals broadly ovate, mostly acute; sterile filament more shortly bearded, much of the expanded white apex frequently glabrous; basal and stem leaves broadly obovate to elliptic-ovate.....

45. *P. versicolor*.
Corolla 15 to 20 mm. long; sterile filament slightly enlarged distally, densely bearded with yellowish hairs; stem leaves ovate, the upper ones acuminate to rounded-mucronate, thickened-fleshy.

Corolla 18 to 20 mm. long; sterile filament relatively short-bearded.

46. *P. lentus*.

Corolla 15 to 18 mm. long; sterile filament relatively long-bearded.

47. *P. pachyphyllus*.

Corolla 10 to 25 mm. long, glabrous within (sometimes somewhat lanate-pubescent in *P. arenicola*), changing from pink to coerulean blue; sterile filament less densely bearded.

Corolla 25 mm. long; sterile filament slightly enlarged distally, slightly bearded near the apex; sepals lance-attenuate, 8 mm. long; stems in large clumps; lowest leaves linear, the upper ones lanceolate; bracts large, ovate-acuminate, the lower ones elongate.....

48. *P. haydeni*.
Corolla 10 to 20 mm. long; sterile filament obviously enlarged distally, more strongly bearded, especially toward the apex; sepals acute to acuminate, 4 to 8 mm. long; stems in small clumps; lowest leaves not conspicuously narrower than the upper ones; bracts not so conspicuously enlarged.

Sterile filament moderately enlarged distally, but not terminating in a broad white apex; seeds more than one-half as wide as long, dark brown; lower bracts more or less elongate, linear-lanceolate to lanceolate. Leaves linear to lanceolate, acuminate; corolla 15 to 20 mm. long.

Bracts elongate, mostly gradually tapering from the base; corolla 15 to 18 mm. long, the lobes spreading less than 12 mm. wide; capsule narrowly ovate to ovate, mostly 7 to 8 mm. wide.

49. *P. angustifolius*.

Bracts less elongate, mostly abruptly contracted from the widened base; corolla usually nearly 20 mm. long, the lobes spreading 15 mm. wide; capsule more broadly ovate, about 10 mm. wide.

49a. *P. angustifolius caudatus*.

Leaves mostly oblanceolate, obtusely mucronate to short-acuminate; corolla 10 to 15 mm. long.....

50. *P. arenicola*.
Sterile filament expanded distally into a broad white apex; seeds less than or about one-half as wide as long, reddish brown; lower bracts not elongate, ovate.

Sepals lance-acuminate; capsule pale brown; seeds about 3 mm. long.

51. *P. nitidus*.

Sepals ovate, acutish to acute; capsule dark brown; seeds about 4 to 5 mm. long

45. *P. versicolor*
Stamens and style conspicuously exerted; anther sacs approximate.

52. *P. cyathophorus*.

XI. LARICIFOLII.

Plants grayish-puberulent; leaves narrowly linear, more crowded on the lower part of the stem and on the basal branches arising from the elongate caudex; corolla throat strongly inflated.

Plants closely puberulent.....

53. *P. coloradoensis*.
Plants more loosely and strongly puberulent.....

53a. *P. coloradoensis sileri*.

Plants essentially glabrous; leaves filiform or nearly so, closely tufted on abbreviated basal branches arising from the shortened caudex; corolla throat less inflated.

Corolla throat evidently inflated, 9 to 10 mm. long, evidently 2-lipped, the posterior lobes 4 to 7 mm. long, the lobes spreading to a breadth of 10 to 15 mm., "white"; anther sacs ovate-lanceolate; sterile filament densely bearded dorsally.....54. *P. exilifolius*.

Corolla throat slightly inflated, 10 to 12 mm. long, slightly 2-lipped, the posterior lobes 3 to 4 mm. long, the lobes spreading to a breadth of less than 11 mm., light red-violet; anther sacs linear-lanceolate; sterile filament slightly to moderately bearded dorsally.....55. *P. laricifolius*.

XII. AMBIGUI.

A single species.....56. *P. ambiguus*.

XIII. DEUSTI.

A single species.....57. *P. deustus*.

XIV. GRACILES.

Corolla glabrous externally (rarely with a few glandless hairs distally).

Sepals triangular, slightly scarious but nearly entire below, one-third to two-fifths the length of the capsule. Thyrsus of lax fascicles; flowers more distinctly pediceled.....58. *P. watsoni*.

Sepals long-acuminate to caudate-tipped, conspicuously scarious and more or less erose-lacerate below, at least one-half the length of the capsule.

Corolla 8 to 10 mm. long, the throat 2 mm. wide.

Calyx glabrous externally.

Sepals with long caudate tip and with relatively slightly toothed scarious margin.....59. *P. procerus*.

Sepals with short caudate tip and with relatively more lacerate scarious margin.....59a. *P. procerus aberrans*.

Calyx pubescent externally.....59b. *P. procerus pulvereus*.

Corolla 10 to 18 mm. long, the throat 2.5 to 4 mm. wide.

Corolla 10 to 14 mm. long, densely pubescent within, deep violet-blue; sepals with conspicuously broad, strongly lacerate margin below, and relatively shorter tip, always glabrous; thyrsus densely congested..60. *P. rydbergii*.

Corolla 15 to 18 mm. long, slightly to moderately pubescent within, lighter violet-blue; sepals with narrower, less lacerate margin below, and relatively longer tip, pubescent or glabrous; thyrsus less densely congested.

61. *P. aggregatus*.

Corolla glandular-puberulent externally.

Corolla pale to deep blue, the throat 1.8 to 4 mm. wide; capsule lance-ovate, 5 to 7 mm. long; plants erect, 10 to 80 cm. tall; thyrsus of many several-flowered axillary clusters.

Corolla deep or violet blue, slightly paler anteriorly, the throat less strongly ridged within anteriorly and not apparently inflated posteriorly, the posterior lobes abruptly spreading and but little exceeded by the anterior ones; plants ascending from creeping stems.

Corolla 15 to 20 mm. long; stem puberulent in lines. Blades of basal leaves over 3 cm. long.

Corolla 17 to 20 mm. long, deep blue, the throat slightly inflated; sepals 3.5 to 7 mm. long, with broad and more or less lacerate scarious margin; stem leaves nearly always entire; thyrsus more crowded; plants paler green.....62. *P. pseudoprocerus*.

Corolla 15 to 18 mm. long, violet-blue or blue, the throat more inflated; sepals 3 to 4 mm. long, with narrow, nearly entire, scarious margin; stem leaves frequently dentate; thyrsus lax; plants deeper green.

63. *P. virens*.

Corolla 8 to 12 mm. long; stem uniformly puberulent.

Plants greenish, minutely puberulent, 10 to 30 cm. tall; basal leaves ovate to broadly oval; stem leaves mostly oblong-lanceolate to oval-ovate; sepals lanceolate, two-thirds to three-fourths the length of the capsule.

Trailing subaerial rhizome-like stems much developed; blades of basal leaves ovate to broadly ovate, acute, 1.5 to 2.5 cm. long, 1 to 2 cm. wide; stem leaves mostly oval-ovate.....64. *P. brevifolius*.

Trailing subaerial rhizome-like stems little developed; blades of basal leaves broadly ovate, obtuse (to acutish), 2 to 3 cm. long, 1.5 to 2.2 cm. wide; stem leaves mostly oblong-lanceolate..65. *P. obtusifolius*.

Plants grayish, evidently puberulent throughout, 20 to 40 cm. tall; basal leaves lanceolate to narrowly ovate; stem leaves lanceolate; sepals triangular to ovate-acuminate, about one-half the length of the capsule.....66. *P. humilis*.

Corolla pale blue, decidedly paler anteriorly, the throat strongly ridged within anteriorly and abruptly and slightly inflated posteriorly, the posterior lobes projecting, spreading only at the apex, somewhat exceeded by the anterior ones; plants strictly erect.

Plant grayish-puberulent throughout. Rootstock slender, much branched and densely matted. Leaves entire.....67. *P. radicosus*.

Plants green, minutely puberulent or glabrous; rootstock stout, less branched and not matted.

Leaves entire; blades of basal leaves mostly 2 to 3 cm. long, those of the cauline ones lanceolate-linear and mostly shorter than the internodes; thyrsus lax, the lower peduncles ascending, mostly 2 to 4 cm. long, the pedicels over 5 mm. long.....68. *P. oliganthus*.

Leaves denticulate; blades of basal leaves mostly 3 to 5 cm. long, those of the cauline ones narrowly lanceolate and mostly longer than the internodes; thyrsus more strict, the lower peduncles erect, rarely 2 cm. long, the pedicels shorter.....69. *P. gracilis*.

Corolla violet, the throat 5 to 6 mm. wide; capsule ovate, 8 to 9 mm. long; plants spreading in tufts, 10 cm. tall; thyrsus of few usually 1-flowered fascicles.

70. *P. harbourii*.

XV. CAESPITOSI.¹

Leaves linear-lanceolate to obovate.

Leaves cinereous-whitened; plants little spreading.

Stems 15 to 20 cm. tall; calyx lobes not scarious, acutish, 3 to 5 mm. long; corolla 16 to 20 mm. long, the anterior lobes decidedly exceeding the posterior ones.

71. *P. retrorsus*.

Stems rarely 10 cm. tall; calyx lobes scarious-margined below, acuminate, dentate, 5 to 8 mm. long; corolla 15 to 17 mm. long, the anterior lobes scarcely exceeding the posterior ones.....72. *P. thompsoniae*.

Leaves light green; plants widely spreading, forming mats.

Corolla 20 to 25 mm. long, with broad tube, more deeply 2-lipped. Anterior corolla lip 5 to 7 mm. long.....73. *P. crandallii*.

¹ Limitation of species of this group difficult and unsatisfactory. They need much more field study.

Corolla 15 to 20 mm. long, with narrow tube, less deeply 2-lipped.

Leaves glabrate; calyx lobes less puberulent, scarious-margined. Stems usually more ascending, sometimes 10 cm. tall.

Leaves obovate, obtusish; calyx lobes acute.....74. *P. suffrutescens*.

Leaves lanceolate, acute or acutish; calyx lobes acuminate....75. *P. xylus*.

Leaves canescent; calyx lobes densely puberulent, not or scarcely scarious-margined.

Leaves narrowly oblanceolate to obovate, reaching 1 to 2 cm. long; branches more ascending at apex, frequently 3 to 4 cm. tall.

76. *P. caespitosus*.

Leaves spatulate-obovate, mostly shorter; plant with branches scarcely ascending.....76a. *P. caespitosus perbrevis*.

Leaves linear or nearly so. Plants heathlike.

Corolla 16 to 18 mm. long.

Leaves canescent; calyx lobes densely puberulent, not or scarcely scarious-margined; corolla more pubescent within.....77. *P. teucrioides*.

Leaves glabrous or nearly so; calyx lobes slightly puberulent, scarious-margined; corolla usually less pubescent within.....78. *P. glabrescens*.

Corolla 12 to 14 mm. long.....79. *P. abietinus*.

XVI. WHIPPLEANI.

A single species.....80. *P. whippleanus*.

XVII. FRUTICOSI.

Leaves ovate, dentate with spreading teeth, pubescent, 2 to 3 cm. long; sterile filament 0.25 to 0.5 mm. wide, slightly lanose or glabrous distally.

81. *P. montanus*.

Leaves lanceolate, slightly dentate or entire, glabrous, 3 to 6 cm. long; sterile filament 1 to 1.5 mm. wide, strongly lanose near the apex.....82. *P. fruticosus*.

XVIII. BRIDGESIANI.

A single species.....83. *P. bridgesii*.

XIX. HETEROPHYLLI.

Anthers purple; seeds 1.5 to 2 mm. long; sepals lanceolate, 5 to 8 mm. long; leaves lanceolate to ovate, 3 to 5 cm. long, green; stems puberulent.

Corolla lavender-violet, 20 to 30 mm. long; anther sacs frequently more or less pubescent on the sides; leaves elliptic-ovate, 4 to 5 cm. long, usually conspicuously acuminate; plants 30 to 70 cm. tall.....84. *P. platyphyllus*.

Corolla violet-blue, 15 to 19 mm. long; anther sacs always glabrous on the sides; leaves lanceolate to oblanceolate, 3 to 5 cm. long, obtuse to acute or somewhat acuminate; plants 10 to 40 cm. tall.....85. *P. leonardi*.

Anthers dark gray; seeds 2 to 3 mm. long; sepals rounded-ovate, 2 mm. long; leaves linear-lanceolate, 6 to 9 cm. long, glaucous; stems glabrous. Corolla violet, 25 to 30 mm. long; plants 60 to 80 cm. tall.....86. *P. sepalulus*.

1. *Penstemon eatoni* A. Gray.

Penstemon eatoni A. Gray, Proc. Amer. Acad. 8: 395. 1872. "Mr. Watson * * * in company with Professor Eaton, found it abundantly in Provo Canyon, Wasatch Mountains," Utah. Isotype, *S. Watson* 776, collected in July, 1869, at 1,800 meters altitude, seen in the herbarium of Columbia University, at the New York Botanical Garden.

Rocky ravines and mountain sides, in the open or among junipers, at altitudes of 1,500 to 2,600 (3,000) meters; Upper Sonoran and Submontane zones; flowering from late April to late July. Foothills and mesas, through the southern Wasatch region from Utah and Wasatch counties to Washington County, Utah, in the San Juan Valley of southwestern Colorado, and in northern Arizona. Southward probably passes into *P. eatoni undosus*.

COLORADO: Montezuma:¹ Mesa Verde, *Vreeland* (M).

UTAH: Beaver: Frisco (U, Y); Milford, *Rydborg & Carleton* 6301 (Y), 6303 (Y). Carbon: Castle Gate, *Pennell* 6137 (H, U, Y). Piute: Jugtown (near Marysvale), *Jones* 5405q (U). San Pete: Indianola, *Tidestrom* 2252 (U). Utah: American Fork Canyon; Provo, *Pennell* 6111 (A, D, S, Y), 6114 (Y), 6121 (F, M, P, R, Y); Thistle (M, U, Y). Wasatch: Midway, *Carleton & Garrett* 6709 (U, Y). Washington: Santa Clara Valley, *Jones* 5129a (M, U, Y); Springdale (U). Wayne: Bromide Mine, *Jones* 5695am (U).

1a. *Penstemon eatoni undosus* Jones.

Penstemon eatoni undosus Jones, Proc. Calif. Acad. II. 5: 715. 1895. "[*M. E. Jones*] No. 5110ah. April 26, 1894, in red sand at St. George, Utah, 2,700° alt." Type seen in U. S. National Herbarium; isotype in herbarium of New York Botanical Garden.

This is the same as *P. coccinatus* Rydb., described from Arizona. Apparently more variable, at least in sepal length, than the species, and here distinguished solely by the pubescence. Perhaps a form rather than a variety, but it seems to have a different range.

"Among the junipers in gravelly soil"; doubtless in situations similar to those of *P. eatoni*, but known from altitudes of 810 to 1,650 meters; Upper Sonoran Zone; flowering from late April to mid-June. In the Colorado drainage, southwestern Colorado, southern Utah, and northern Arizona.

COLORADO: Montezuma: Mesa Verde, *Cary* 186 (U). Montrose: Naturita, *Payson* 333 (F, M, R).

UTAH: Grand: Court House Wash, *Eastwood* 6104 (Y). Kane: Johnson, *Jones* 5289u (U). Washington: St. George, *Jones* 5110ah (U, Y); Silver Reef (Y).

2. *Penstemon torreyi* Benth.

Penstemon torreyi Benth. in DC. Prodr. 10: 324. 1846. "Versus montes Scopulosos (iter Long!) * * * (v. in herb. Torr.)." Type seen in herbarium of Columbia University at the New York Botanical Garden.

Penstemon barbatus torreyi A. Gray, Proc. Amer. Acad. 11: 94. 1876.

Rocky sagebrush and wooded slopes, at altitudes of 1,800 to 3,000 meters; Submontane and Montane zones; flowering from mid-June to late August. Foothills, lower slopes of mountains, and on mesas, from Garfield, Lake, and Teller counties, central Colorado, southward into New Mexico; on both continental slopes.

COLORADO: Archuleta: La Pagosa, *Newberry* (U). Chaffee: Buena Vista; Salida, *Pennell* 6308 (Y). Costilla: Placer, *Shear* 3630 (Y). El Paso: Artists Glen, *Clements* 100 (M, U, Y); Bison Creek (F); Cascade; Mount Manitou (F); North Cheyenne Canyon (Y); Ute Pass (M, P). Fremont: Canon City, *Brandegge* 85 (M). Garfield: Glenwood Springs; Shoshone, *Pennell* 6160 (D, M, U, Y), 6163 (R, Y). Gunnison: Sapinero, *H. N. Wheeler* (B). Hinsdale: Lake City, *Newberry* (Y). Lake: Twin Lakes, *Porter* (A). La Plata: Rockwood, *Tweedy* 418 (U). Las Animas: Berwind (B); Stonewall, *Beckwith* 170 (Y); Trinidad (U, Y).

¹ In lists of exsiccatae names of counties are given in alphabetical sequence, and are each followed by a colon.

Mineral: Wagon Wheel Gap, *B. H. Smith* (A). Montrose: Cimarron, *Pennell* 6249 (F, Y). San Miguel: Norwood Hill, *Walker* 457 (R). Teller: Florissant, *Ramaley* 1374 (B).

3. *Penstemon barbatus* (Cav.) Roth.

Chelone barbata Cav. Icon. Pl. 3: 22. pl. 242. 1794. "Habitat in Imperio Mexicano, unde nuperrime introducta in hortum Regium Pharmaceuticum * * * Floruit * * * 1794." Type not verified.

Penstemon barbatus Roth, Catal. Bot. 3: 49. 1806.

Through central highlands of Mexico, apparently extending northward to southern Utah. Reported from an altitude of 864 meters.

UTAH: Washington: St. George, *Palmer* (F, Y).

3a. *Penstemon barbatus puberulus* A. Gray.

Penstemon barbatus puberulus A. Gray in Torr. U. S. & Mex. Bound. Bot. 114. 1859. "Guadalupe cañon [Arizona], May, 1851; *Thurber*." Type not verified, but evidently the plant here considered.

Arizona and apparently southern Utah. Probably a distinct species.

UTAH: Without locality: *Bishop* 154 (U).

4. *Penstemon trichander* (A. Gray) Rydb.

Penstemon barbatus trichander A. Gray, Proc. Amer. Acad. 11: 94. 1876. "S. W. Colorado, T. S. Brandege, in Hayden's Exploration, 1875." Isotype (no. 1419, "ex herb. J. H. Redfield") seen in herbarium of Academy of Natural Sciences of Philadelphia.

Penstemon trichander Rydb. Bull. Torrey Club 33: 151. 1906.

Hillsides, at altitudes of 1,650 to 2,100 meters; probably Submontane Zone; flowering from mid-June to late July. Foothills and mesas, San Juan and Dolores valleys, southwestern Colorado and southeastern Utah.

COLORADO: Archuleta: La Pagosa (U); Piedra, *Baker* 597 (F, M, U, Y). La Plata: Durango, *Baker, Earle & Tracy* 513 (F, M, U, Y). Montezuma: Mesa Verde, *Vreeland* 877 (Y). Montrose: La Sal Creek, *Payson* 453 (M). San Miguel: Norwood Hill, *Walker* 457.1 (R).

UTAH: San Juan: Allen Canyon, southwest of Abajo Mountains, *Rydberg & Garrett* 9300 (U, Y), 9303 (Y).

5. *Penstemon utahensis* Eastw.

Penstemon utahensis Eastw. Zoe 4: 124. (July) 1893. "It was collected between Hatch's Wash and Monticello [Utah], May 28, 1892." Isotypes, labeled "May, 1892," seen in herbarium of Missouri Botanical Garden and U. S. National Herbarium.

Penstemon confusus Jones, Zoe 4: 280. (October) 1893. "Collected by me at Detroit, western Utah, May 26, 1891." Specimens collected by Jones at Detroit and labeled "June, 1891. *Penstemon Parryi* Gray var. *imberbis* Jones," seen in herbarium of the Missouri Botanical Garden and U. S. National Herbarium. Description composite, of this red-flowered plant and of the blue-flowered *P. pachyphyllus* A. Gray. *P. utahensis*, as here understood, varies in size and acumination of sepals and in width of corolla tube, *P. confusus*, with large acute sepals and broad tube, representing the extreme variation from the type.

Penstemon eastwoodiae Heller, Muhlenbergia 1: 4. 1900. New name for *P. utahensis* Eastw., not *P. glaber utahensis* S. Wats. 1871.

Dry sandy or gravelly slopes, at altitudes of 1,600 to 2,100 meters; Upper Sonoran and Submontane zones; flowering early May to mid-June. Foothills and lower mountains, southern Utah (from Sevier County southward) and northern Arizona.

UTAH: Garfield: Canyon above Tropic, *Jones* 5312ae (U). Iron: Cedar City, *Jones* 5204w (U). Kane: *Siler* (A). Millard: Detroit, *Jones* (M, U). Piute: Marysvale, *Jones* 5338aa (U), 5388p (U), 5410h¹ (U). San Juan: Between Hatch Wash and Monticello, *Eastwood* (M, U). Sevier: Salina Canyon, *Jones* 5419d (U). Washington: Beaverdam Mountains, *Parry* 152 (A, F, M, Y); Silver Reef (U).

6. *Penstemon albidus* Nutt.

Penstemon albidus Nutt. Gen. Pl. 2: 53. 1818. "Hab. On the plains of the Missouri, common, from the confluence of the River Platte to the Mountains." Type seen in herbarium of the Academy of Natural Sciences of Philadelphia.

Chelone albida Spreng. Syst. Veg. 2: 813. 1825.

Sandy to stony or clayey prairies and low hills, in the open, known from altitudes of 900 to 1,830 (2,100) meters; Upper Sonoran and Subboreal zones; flowering from mid-May to early July. High plains, west to the base of the foothills of eastern Colorado and Wyoming. Manitoba to Kansas, eastern Colorado, and Montana.

SOUTH DAKOTA: Custer: Hermosa, *Rydberg* 920 (U). Fall River: Hot Springs, *Rydberg* 918 (U, Y). Meade: Fort Meade, *Forwood* 284 (U). Pennington: *Over* 1843 (U). Stanley: Cedar Pass (U); Fort Pierre, *Hayden* (Y). Washabaugh: Bear Creek (U); Eagle Nest Butte, *Over* 2084 (U).

NEBRASKA: Cherry: Fort Niobrara, *Wilcox* (Y). Deuel: *Rydberg* 278 (U). Hooker: Mullen, *Rydberg* 1316 (U). Keith: Ogallala, *Pennell* 6401 (H, M, Y). Lincoln: Hershey; North Platte, *Pennell* 6408 (Y). Sheridan: Hay Springs, *MacDougal* 38 (Y). Thomas: Halsey (P); Thedford, *Rydberg* 1316 (U).

KANSAS: Ford: Dodge City, *Ellis* (U, Y). Gove: *Hitchcock* 377a (U, Y). Hamilton: Syracuse, *Thompson* 83 (U). Logan: *Hitchcock* 377 (U, Y). Meade: Meade, *B. B. Smyth* 137 (U). Seward: *Carleton* 213 (U).

WYOMING: Crook: Sundance, *Nelson* 2241 (M). Goshen: Torrington, *Nelson* 8290 (M). Johnson: Buffalo, *Lothian* (R). Laramie: Cheyenne, *Ball* 1769 (U). Sheridan: Big Horn, *Tweedy* 2328 (Y).

COLORADO: Bent: Rule Creek; Las Animas, *Osterhout* 3917. Denver: Denver, *Pennell* 5844 (Y). Elbert: Bijou Basin, *Jones* 171 (B, F, Y). El Paso: Nob Hill, *Pennell* 5795 (Y). Kiowa: Eads, *Baker, Earle & Tracy* 813 (M, Y). Logan: Sterling, *Osterhout* 988 (Y). Prowers: 25 miles south of Lamar, *Osterhout* 5060. Sedgwick: Julesburg, *Pennell* 6398 (B, D, U, Y). Weld: Greeley, *Johnston* 281 (M); Pawnee Buttes (B).

7. *Penstemon jonesii* Pennell, sp. nov.

Stems several, 40 to 80 cm. tall, finely pubescent throughout with reflexed hairs; lowest leaves narrowed to petiole-like bases, the longest 7 to 9 cm. long, spatulate-ob lanceolate to obovate, more or less deeply emarginate; lower stem leaves similar, the upper ovate, rounded-clasping, the bases of each pair meeting, finely pubescent throughout; thyrsus narrow, of 10 to 20 fascicles, each of 2 short axillary branches, their pedicels longer than the peduncle; sepals 3 to 4 mm. long, broadly ovate, abruptly short-caudate, with evident erose scarious margin, glabrous; corolla 23 to 25 mm. long, the tube gradually expanding into the cylindric throat, the two together 18 to 19 mm. long, 5 to 6 mm. wide, slightly inflated, rounded, the lobes 5 to 6 mm. long, the 2 posterior ones united and arched for three-fifths their length, the 3 anterior ones united two-fifths their length, all the free portions projecting forward, glabrous without and within, blue (not seen fresh); anther sacs divaricate, 2 to 2.2 mm. long, with short line of contact, each opening partially distally, the suture fimbri-

¹ "At the top of the grade between Marysvale and Monroe," probably in Sevier County.

olate, the sacs elsewhere with minutely puberulent surface; sterile filament included, flattened, scarcely enlarged distally, glabrous or with a few short hairs at apex; capsule ovate, glabrous (not seen mature).

Type in the U. S. National Herbarium, no. 260627, collected at Springdale, Utah, altitude 1,200 meters, in flower, May 17, 1894, by M. E. Jones, (no. 5250, in part; distributed as *P. glaber* Pursh). Another sheet of the same collection is the type of *P. laevis*, described below (p. 347).

At altitudes of 1,200 to 1,600 meters; Upper Sonoran Zone; flowering in May. Virgin and Kanab valleys, southwestern Utah.

UTAH: Kane: Kanab, Jones 5286x (M). Washington: Springdale, Jones 5250 (U).

8. *Penstemon leptanthus* Pennell, sp. nov.

Stems several, 15 to 25 cm. tall, below densely canescent-puberulent with reflexed hairs, above becoming glabrate, from a short branched caudex; leaves not thickened, dull pale green above and beneath, obscurely veined, entire, densely cinereous-puberulent, those at the base of the stem with lanceolate blades, these obtuse to acutish, 5 to 6 cm. long, gradually narrowed to margined petioles 1 to 2 cm. long, the leaves on the stem sessile (the bases of opposite leaves not meeting), acutish, the largest 3 to 5 cm. long, 0.5 to 0.9 cm. wide; thyrsus narrow, less than one-half the height of the plant, of about 9 fascicles, each of 2 axillary short branches, their pedicels shorter than the peduncle; sepals 3 mm. long, ovate, acute, obscurely or not ribbed, slightly scarious-margined and slightly erose, proximally nearly glabrous; corolla 13 to 15 mm. long, the tube and throat 11 to 12 mm. long, the throat slightly inflated and rounded ventrally, the 2 posterior lobes 2 to 3 mm. long, united and arched about one-fourth their length, projecting, the 3 anterior lobes 2 to 3 mm. long, united at base, slightly spreading, the corolla glabrous without and within, probably blue (not seen fresh); anther sacs divaricate, 1 mm. long, lanceolate-oblong, minutely puberulent, opening distally most of their length, the suture glabrous; sterile filament scarcely exerted, flat, scarcely enlarged distally, bearded on the posterior face, especially distally, with yellow hairs; capsule not seen.

Type in the U. S. National Herbarium, no. 146868 (in part), collected in central Utah, in flower, by L. F. Ward in 1875. This was probably part of Ward's no. 280, collected at Twelve Mile Creek Canyon, near Mayfield, Utah, June 28, 1875, although mounted with and bearing the label of Ward 546 from The Button, Aquarius Plateau, Utah (see remarks under *P. parvus*, p. 345). It was distributed as *P. acuminatus* Dougl.

9. *Penstemon fremontii* Torr. & Gray.

Penstemon fremontii Torr. & Gray; A. Gray, Proc. Amer. Acad. 6: 60. 1862. "On the Uinta plains, very abundant and in large patches. June 5, 1844." Type, collected by Frémont, seen in herbarium of Columbia University at the New York Botanical Garden.

Penstemon glaber fremontii Jones, Contr. West. Bot. 12: 62. 1908.

Dry butte sides and sagebrush draws, at altitudes of 1,800 to 2,100 meters; Upper Sonoran Zone; flowering from late May to late June. Red Desert of southwestern Wyoming and northwestern Colorado.

WYOMING: Sweetwater: Bitter Creek (R, Y); Red Desert, Pennell 5882 (Y); Steamboat Mountain (R); Wamsutter, Pennell 5884 (H, M, U, Y).

COLORADO: Rio Blanco: Meeker, Osterhout 2608 (Y). Routt: Hayden, Osterhout 5107, 5224.

10. *Penstemon auriberbis* Pennell, sp. nov.

Stems several, 10 to 20 cm. tall, below cinereous-puberulent with reflexed hairs, above spreading-pubescent with narrow-headed gland-tipped hairs; leaves linear to

linear-lanceolate, the longest 4 to 10 cm. long, 0.2 to 0.7 cm. wide, those at the base of the stem narrowed to petiole-like bases, those of the stem sessile, rounded to narrowed at base, partly clasping, all finely canescent-puberulent, the upper leaves and bracts more or less glandular-pubescent; thyrsus narrow, of 3 to 6 fascicles, each composed of 2 short axillary branches, their pedicels shorter than or equaling the peduncle; sepals 8 mm. long, lanceolate, acuminate, glandular-pubescent; corolla 20 to 25 mm. long, the tube 4 to 5 mm. long, 3 to 3.5 mm. wide, the throat 8 to 10 mm. long, 8 to 9 mm. wide, much inflated and rounded, the lobes 8 to 10 mm. long, 8 mm. wide, the 2 posterior ones united and arched for one-half their length, the 3 anterior ones united slightly at base, all the free portions widely spreading, the corolla externally glandular-puberulent, within somewhat pubescent over the bases of the anterior lobes, purplish blue, not or faintly lined within the throat; anther sacs widely divaricate, 1.4 to 1.5 mm. long, lance-oblong, with short line of contact, pale, or violet-tinged on side, from distal apex opening nearly throughout, the suture fimbriolate; sterile filament 15 to 17 mm. long, more or less exserted, flattened, gradually enlarged distally, at times decurved at apex, densely bearded on the posterior face nearly to the base with orange-golden hairs; capsule 8 to 10 mm. long, ovate, acuminate, glabrous; seeds 2.5 to 3 mm. long, irregularly lanceolate-curved in outline, the angles obscure, the surface finely alveolate-reticulate, blackish brown.

Type in the herbarium of the New York Botanical Garden, collected on a dry sandy sagebrush slope, east of Fountain Creek, northeast of Pueblo, Pueblo County, Colorado, altitude about 1,400 meters, in flower, June 5, 1915, by F. W. Pennell (no. 5731).

This species has been identified as *P. jamesii* Benth., but examination of the type of that species, in Torrey's herbarium (Columbia University Herbarium) at the New York Botanical Garden, shows that his name should replace *P. similis* A. Nels. *P. similis* occurs on the Staked Plains of eastern New Mexico and northwestern Texas, and it was doubtless on these or in near-by western Oklahoma, while on the return route of Long's expedition, that Doctor James collected his plant. *P. jamesii* differs from *P. auriberbis* by having wider leaves, larger flowers, and anther sacs which dehisce throughout and have a broad line of contact.

*Sandy or loam sagebrush slopes, at altitudes of 1,250 to 2,100 (2,200) meters; Upper Sonoran Zone; flowering mid-May to late June. High plains in the Arkansas Valley of southeastern Colorado.

COLORADO: Costilla: Sangre de Cristo Creek, *Rydborg & Vreeland* 5635¹ (Y). El Paso: Fountain, *Redfield* 514 (M). Fremont: Canon City, *Pennell* 6312 (D, F, H, M, P, R, U, Y). Huerfano: Badito (Y); La Veta (Y); Walsenburg, *Rydborg & Vreeland* 5633 (R, Y). Las Animas: Barela, *T. A. Williams* (Y). Otero: Apishpa River; Rocky Ford, *Osterhout* 2084 (Y). Pueblo: Pueblo, *Pennell* 5731 (H, R, U, Y), 5733 (D, F, M, P, Y); Swallows (M, R, U, Y).

A hybrid with *P. angustifolius caudatus* (Heller) Rydb. was collected at Pueblo, *Pennell* 5733a (U, Y).

11. *Penstemon parviflorus* Pennell, sp. nov.

Stem 15 to 20 cm. tall, cinereous-puberulent with reflexed hairs, above spreading-pubescent with gland-tipped hairs; leaves linear to linear-lanceolate, the longest about 5 cm. long, 0.3 to 0.5 cm. wide, those at the base of the stem gradually narrowed to petiole-like bases, those of the stem sessile, gradually narrowed to base, partly clasping, canescent-puberulent, the upper leaves and bracts more or less glandular-pubescent; thyrsus narrow, of at least 6 loose fascicles, each composed of 2 axillary

¹ As this is only record from west of Sangre de Cristo Range, and as the collectors upon the same expedition collected extensively east of that range, it is probable that there has been some confusion of data.

branches, their pedicels shorter than the peduncle; sepals 8 mm. long, lanceolate, acuminate, glandular-pubescent; corolla 12 mm. long, the tube and throat 7 mm. long, about 4 mm. wide, much inflated and rounded, the lobes 4 to 5 mm. long, the 2 posterior ones united and arched one-third to one-half their length, the 3 anterior ones united slightly at base, their free portions spreading, the corolla externally glandular-puberulent, within pubescent over the bases of the anterior lobes, probably purplish blue (not seen fresh); anther sacs widely divaricate, 1 to 1.2 mm. long, with short line of contact, the suture fimbriolate, the surface elsewhere minutely puberulent; sterile filament about 5 to 6 mm. long, apparently included, flattened, enlarged distally, densely bearded on the posterior face nearly to the base with yellow hairs; capsule not seen.

Type in the U. S. National Herbarium, no. 215626, collected at Mancos, Montezuma County, Colorado, in flower, July, 1890, by Alice Eastwood. This was distributed as *P. jamesii* Benth.

Upper Sonoran Zone.

12. *Penstemon dolius* Jones, sp. nov.

Stems several, 2 to 12 cm. tall, from a short branched caudex, cinereous-puberulent throughout with reflexed hairs; leaves dull above, pale beneath, cinereous-puberulent, those at the base of the stem with lanceolate-ovate blades, these acute, 1.2 to 3 cm. long, narrowed into margined petioles 0.7 to 2 cm. long, the stem leaves sessile (opposite leaves not meeting around the stem), oblanceolate, obtusish to acute, the largest mostly 1.5 to 4 cm. long, 2 to 8 mm. wide; thyrsus narrow, over one-half the height of the plant, composed of 3 to 6 fascicles, each consisting of 2 short axillary branches; sepals 7 to 9 mm. long, linear-lanceolate, acuminate, obscurely or not ribbed, entire, not scarious-margined, densely puberulent; corolla 15 to 18 mm. long, the tube and throat 11 to 13 mm. long, the throat somewhat inflated and rounded ventrally, the 2 posterior lobes 2 to 5 mm. long, united and arched much less than one-half their length, the 3 anterior lobes 3 to 6 mm. long, all the free lobes widely spreading, the corolla externally sparsely glandular-puberulent, within slightly pubescent or glabrous over the bases of the anterior lobes, blue (not seen fresh); anther sacs widely divaricate, 0.8 to 0.9 mm. long, lance-oblong, minutely puberulent, distinct, with medium line of contact, opening throughout, the suture fimbriolate; sterile filament 8 to 10 mm. long, scarcely exerted, flat, slightly enlarged distally, moderately bearded, especially toward apex, with relatively (to *P. eriantherus*) short yellow hairs on the posterior face; capsule not seen.

Type in the U. S. National Herbarium, collected at Willow Springs, Nevada, in flower, June 5, 1891, by M. E. Jones. Isotypes in herbaria of the New York Botanical Garden and the Missouri Botanical Garden.

Probably dry sagebrush slopes, at altitudes of 1,500 to 1,650 meters; Upper Sonoran Zone; flowering mid-May to early June. Valley of Duchesne River, northeastern Utah, of the Sevier River in central Utah, and in eastern Nevada.

UTAH: Sevier: Red hills north of Redmond, *Eggleston* 11130 (U). Wasatch: Theodore to Myton, *Jones* (U, Y; this collection differs in its dwarf habit and more widely spreading corolla lobes, and only because of the variability in the corolla lobes of the type of *P. dolius* is it placed with this species).

In the Gray Herbarium are two specimens bearing data in the handwriting of Asa Gray, "S. Utah, Siler in litt.," determined by him as *P. "pumilus* var. *Thompsoniae*." These are evidently an undescribed plant allied to *P. dolius* but which has the line of contact of the more puberulent anther sacs very short. The specimens are both incomplete, showing only the inflorescence.

13. *Penstemon paysonii* Pennell, sp. nov.

Stems several, 8 to 16 cm. tall, from a short branched caudex, below cinereous-puberulent with reflexed hairs, above pubescent with gland-tipped hairs; leaves pale green above and beneath, cinereous-puberulent, those at the base of the stem with lanceolate acute blades 1.5 to 3 cm. long, these narrowed into margined petioles 1.5 to 3 cm. long, the stem leaves sessile (opposite leaves meeting around stem), linear-lanceolate, obtusish to acute, the largest mostly 4 to 5 cm. long, 3 to 5 mm. wide; thyrsus narrow, over one-half the height of the plant, composed of 4 to 6 fascicles, each of these consisting of 2 axillary shortened branches, their pedicels shorter than the peduncle; sepals 8 to 9 mm. long, lanceolate, acuminate, obscurely or not ribbed, entire, slightly scarious-margined proximally, glandular-puberulent; corolla 18 to 22 mm. long, the tube and throat 14 to 16 mm. long, the throat somewhat inflated and rounded ventrally, the 2 posterior lobes 4 to 5 mm. long, united and arched much less than one-half their length, the 3 anterior lobes 5 to 6 mm. long, united at base, all the free portions spreading, the corolla externally glandular-puberulent, within glabrous, blue (not seen fresh); anther sacs widely divaricate, 0.9 mm. long, oblong-lanceolate, minutely puberulent, distinct, with medium line of contact, opening throughout, the suture slightly fimbriolate; sterile filament not exerted, flat, slightly enlarged distally, moderately strongly bearded distally with relatively (to *P. eriantherus*) short yellow hairs on the posterior face; capsule not seen.

Type in the herbarium of the Missouri Botanical Garden, collected on rocky hillsides at Naturita, Montrose County, Colorado, altitude 1,620 meters, in flower, April 27, 1914, by Edwin Payson (no. 257). Isotypes in herbarium of Field Museum of Natural History and Rocky Mountain Herbarium.

Upper Sonoran Zone. Valley of Dolores River in southeastern Colorado.

14. *Penstemon moffatti* Eastw.

Penstemon moffatti Eastw. Zoe 4: 9. 1893. "It was collected at Grand Junction [Colorado] along the railroad to the coal beds." Specimen in herbarium of the New York Botanical Garden, collected at Grand Junction by Alice Eastwood, May, 1891, is doubtless an isotype.

Penstemon pseudohumilis Jones, Contr. West. Bot. 12: 65. 1908. "This grows in clay soil at Price, Utah, [*M. E. Jones*] May 29, 1898 (type in Herb. Jones)." Type not verified, but apparently of the species here considered.

Arid sagebrush plains and slopes, at altitudes of 1,400 to 1,600 meters; Upper Sonoran Zone; flowering in May. In the Grand River drainage of western Colorado and eastern Utah.

COLORADO: Mesa: De Beque (Y); Grand Junction, *Eastwood* (M, U, Y), *Pennell* 6173 (D, F, H, R, U, Y).

UTAH: Grand: Thompsons ("Thompson's Springs"), *Jones* (M, Y).

15. *Penstemon eriantherus* Pursh.

Penstemon eriantherus Pursh, Fl. Amer. Sept. 737. 1814. "In Upper Louisiana, Bradbury * * * v. s. in *Herb. Bradbury*." According to Bradbury (Travels 318. 1817), "Common on bluffs from Big Bend to Aricara Village," South Dakota. Type or isotype, labeled "Louisiana, Bradbury," seen in herbarium of the Academy of Natural Sciences of Philadelphia. Not *P. erianthera* Nutt. in Fraser's Cat. 1813, *nomen nudum*; later published by Nuttall in 1818. The latter is *P. glaber* Pursh, a species with hirsute anthers. Pursh, attempting to apply Nuttall's catalogue name to the specimens brought back by Bradbury from the joint Missouri expedition of Bradbury and Nuttall, applied *erianthera* to a species with glabrous anthers, misled evidently by the long beard of the sterile filament. To the writer it seems a violation of scientific accuracy to hold such a misnomer, but according to all present codes the

name, because in Pursh's Flora first accompanied by a description, must be maintained as there applied.

Penstemon cristatus Nutt. (in Fraser's Cat. 1813, *nomen nudum*) Gen. Pl. 2: 52. 1818. "Hab. On arid denudated argillaceous hills from the confluence of Teeton River and the Missouri [South Dakota] to the Mountains." Type seen in herbarium of the Academy of Natural Sciences of Philadelphia. The original name of Nuttall, which in justice should be restored.

Chelone erianthera Steud. Nom. Bot. 186. 1820-4.

Chelone cristata Spreng. Syst. Veg. 2: 813. 1825.

Dry sandy plains and rocky hills, in the open, at altitudes of 1,400 to 2,400 meters; Submontane (Subboreal) Zone; flowering from early June to early July. Northern high plains, upper Missouri drainage south to southeastern Wyoming.

SOUTH DAKOTA: Custer: Bull Springs, *Rydborg* 919, in part (U). Meade: Elk Canyon,

Rydborg 919, in part (U, Y); Fort Meade (U). Stanley: Saddle Pass, *Over* 6116 (U).

WYOMING: Albany: Dale Creek; Laramie, *Pennell* 5877 (Y); Tie Siding. Carbon:

Fort Steele, *Tweedy* 4304 (U, Y); Saratoga (F); T B Ranch (M). Converse:

Douglas, *Bates* (E). Fremont: Shoshone Agency, *S. R. Martin* (P). Laramie:

Near Cheyenne, *Greene* (Y); Islay (U). Sheridan: Between Sheridan and Buf-

falo, *Tweedy* 3418 (Y). Weston: Newcastle, *J. M. Bates* (U). Yellowstone

National Park: Gardiner River, *Tweedy* 865 (F, U).

15a. *Penstemon eriantherus saliens* (Rydb.) Pennell.

Penstemon saliens Rydb. Mem. N. Y. Bot. Gard. 1: 344. 1900. "Montana: Columbia Falls, *Mrs. J. J. Kennedy*, 53." Type seen in herbarium of the New York Botanical Garden.

The prevalent form in western Montana, extending into the Yellowstone National Park.

WYOMING: Yellowstone National Park: Mammoth Hot Springs, *Scheuber* 331 (Y).

16. *Penstemon ophianthus* Pennell, sp. nov.

Stems several, 10 to 30 cm. tall, from a branched caudex, below densely puberulent with reflexed hairs, above puberulent with spreading gland-tipped hairs; leaves dull green above and beneath, entire or slightly sinuate-dentate, somewhat cinereous-puberulent to glabrate, those at the base of the stem with lanceolate, obtuse to acutish blades 3 to 5 cm. long, these gradually narrowed into margined petioles 2 to 3 cm. long, the stem leaves sessile (opposite leaves not meeting around stem), acutish, the largest mostly 6 to 7 cm. long, 0.8 to 1 cm. wide; thyrsus narrow, mostly over one-half the height of the plant, composed of 4 to 10 fascicles, each consisting of 2 short axillary branches, their pedicels about equaling the peduncle; sepals 7 to 9 mm. long, lanceolate, acuminate, obscurely or not ribbed, entire, slightly scarious-margined proximally, glandular-puberulent; corolla 15 to 20 mm. long, the tube and throat 11 to 15 mm. long, the throat inflated and rounded ventrally, the 2 posterior lobes 4 to 5 mm. long, united and arched one-third their length, projecting forward, the 3 anterior lobes 4 to 5 mm. long, united at base, spreading; corolla externally glandular-puberulent, within lanate with long (white) hairs over the bases of the anterior lobes, bluish (not seen fresh; "red-lilac" according to *Payson* 347); anther sacs widely divaricate, 0.8 mm. long, ovate, glabrous, distinct, with long line of contact, this equaling the length of either sac, opening throughout, the suture nearly glabrous; sterile filament exserted, flat, scarcely enlarged distally, slightly decurved at the apex, bearded on the posterior face, especially distally, with long yellow hairs; capsule 10 to 11 mm. long, ovate, acuminate, glabrous; seeds 3 to 3.5 mm. long, irregularly lanceolate-curved in outline, the angles prominent, the surface finely alveolate-reticulate, dark brown.

Type in the U. S. National Herbarium, no. 327015, collected at Thurber, Utah, altitude 2,100 meters, in flower and fruit, August 1, 1894, by M. E. Jones (no. 5708; distributed as *P. moffatti* Eastw.). Isotypes in herbaria of Missouri Botanical Garden and New York Botanical Garden.

Dry mesas, at altitudes of 1,600 to 2,100 meters; Upper Sonoran Zone; flowering late May to late June. Colorado drainage of southwestern Colorado and southeastern Utah, southward into northern New Mexico and northern Arizona.

COLORADO: Montezuma: Mancos, *Baker, Earle & Tracy* 410 (F, M, U, Y). Montrose: Naturita, *Payson* 347 (F, M).

UTAH: Garfield: *Siler* (M). Wayne: Thurber, *Jones* 5708 (M, U, Y).

17. *Penstemon cleburnei* Jones.

Penstemon cleburnei Jones, Contr. West. Bot. 12: 62. 1908. "This is common on the Green River Desert, Wyoming, at Granger and Green River, and appears to have been first collected since the time of Nuttall by Cleburne, June 27, 1875. It is also A. Nelson's no. 4716." Type (in Jones Herbarium) and specimen of Nuttall not seen, but description, and also specimen of A. Nelson, indicate the plant here considered.

Penstemon auricomus A. Nels.; Rydb. Bull. Torrey Club 36: 688. 1909. "*Penstemon jamesii* A. Nelson, Bull. Torrey Club 25: 547. 1898" (as to description). "Recent collections * * * by the writer in the Red Desert of Wyoming in 1897 (no. 3052) and again in 1898 (no. 4716)." Isotype, *Nelson* 3052, collected at Green River, Sweetwater County, Wyoming, May 31, 1897, seen in herbarium of the New York Botanical Garden.

Stony hillsides, at altitudes of 1,800 to 2,000 meters; Upper Sonoran Zone; flowering from late May to late June. Red Desert of southwestern Wyoming.

WYOMING: Carbon: Fort Steele, *Nelson* 5384 (R). Sweetwater: Green River, *Nelson* 3052 (M, R, Y), 4716 (F, R), *Pennell* 5893 (Y).

18. *Penstemon petiolatus* T. S. Brandeg.

Penstemon petiolatus T. S. Brandeg. Bot. Gaz. 27: 455. 1899. "Sheep mountain, Nevada, at 5,000 ft. altitude, *Dr. C. A. Purpus*, no. 6136." Isotype seen in herbarium of the New York Botanical Garden; also, through the courtesy of Dr. H. M. Hall, a fragment of the type from the University of California. The original description must be modified so as to denote a plant cinereous-puberulent throughout, somewhat glandular-pubescent on the stem above and on the inflorescence, and with a bearded sterile filament. The original collection consisted of plants past normal flower, but with old shriveled corollas still attached. The specimens of A. L. Siler cited below are certainly the same species, and are in full blossom. They show more clearly the glandular inflorescence and the bearded sterile filament, and apparently that the corolla is reddish.

"Crevices of limestone rock"; probably Upper Sonoran Zone; flowering in March. Beaverdam Mountains of southwestern Utah and mountains of southern Nevada.

UTAH: Washington: Beaverdam Mountains, *Siler* (A).

19. *Penstemon palmeri* A. Gray.

Penstemon palmeri A. Gray, Proc. Amer. Acad. 7: 379. 1868. "Arizona, in Skull Valley, and on Rio Verde, near Fort Whipple, Drs. Elliott Coues and Edward Palmer."

At an altitude of about 2,400 meters; Upper Sonoran Zone; flowering in late June. Southwestern Utah and central Arizona to eastern California.

UTAH: Beaver: Frisco, *Jones* 1820 (F, U, Y). Kane: *Siler* (A).

20. *Penstemon hallii* A. Gray.

Penstemon hallii A. Gray, Proc. Amer. Acad. 6: 70. 1862. "Rocky Mountains near Clear Creek [Colorado], etc., in the alpine region, coll. 1862, Parry, Hall and

Harbour: no. 388, distrib. Hall and Harbour." Isotypes seen in herbaria of the Academy of Natural Sciences of Philadelphia, Field Museum of Natural History, Missouri Botanical Garden, and Brooklyn Botanic Garden.

Rocky knolls, above timber line, at altitudes of 3,100 to 3,900 meters; Alpine Zone; flowering from early July to late August. High mountains, Front Range from Grays Peak southward, Sawatch Range, Pikes Peak, Sangre de Cristo Range, and San Juan and adjacent ranges, Colorado.

COLORADO: Chaffee: Mount Princeton, *Sheldon* 549 (U). Clear Creek: Grays Peak, *Patterson* 119 (F, M, U, Y); Mount McClellan (F). El Paso: Mount Garfield (Y); Pikes Peak, *Pennell* 6328 (D, R, Y). Lake: Mount Elbert, *W. A. Henry* (U). Park: Mountains north of Boreas (U); mountains above Como (Y); Horseshoe Mountain, *Coulter* (U, Y). San Juan: Engineer Mountain (F); Mineral Point (M); Needle Mountains (U); Silverton, *Tweedy* 167 (U). Summit: Argentine Pass, *Jones* 408 (B, Y). County uncertain: Sangre de Cristo Range, *Brandegge* 805 (M).

21. *Penstemon parvus* Pennell, sp. nov.

Stems several, 5 to 10 cm. tall, from a relatively long slender caudex, slender, puberulent, not glandular or glaucous; leaves green, not glaucous, obscurely veined, puberulent, those at the base of the stem with oblanceolate-obovate acutish blades, 2 to 2.5 cm. long and 4 to 5 mm. wide, narrowed into ill-defined petiole-like bases, those of the stem similar, smaller, with narrowed, slightly clasping base, becoming much reduced in the inflorescence; thyrsus narrow, probably secund, raceme-like, not over one-fourth the height of the plant, composed of 1 or 2 fascicles, each consisting of 1 or 2 axillary one-flowered branches (the flowers but 1 to 4); sepals 4 mm. long, ovate, acute, not veined, not or scarcely scarious-margined and erose-margined, sparsely and finely glandular-puberulent; corolla 20 mm. long, the tube and throat 14 mm. long, the tube narrow, the throat inflated and rounded ventrally, the 2 posterior lobes 6 mm. long, united and arched over one-half their length, probably projecting, the 3 anterior lobes slightly shorter, united at base, the free portions spreading; corolla externally glandular-puberulent, within glabrous, blue (not seen fresh); anther sacs widely divaricate, 1 mm. long, lance-ovate, distinct, opening from distal apex throughout, glabrous; sterile filament about equaling the anterior pair, slightly enlarging distally, glabrous; capsule not seen.

Type in the U. S. National Herbarium, no. 146868 (in part), collected at The Button, Aquarius Plateau (Garfield or Wayne County), Utah, altitude 3,400 to 3,500 meters, in flower, August 11, 1875, by L. F. Ward (no. 546); distributed as *P. acuminatus* Dougl.

Alpine Zone.

22. *Penstemon unilateralis* Rydb.

Penstemon unilateralis Rydb. Bull. Torrey Club 33: 150. 1906. Based upon "*P. secundiflorus* A. Gray, Syn. Fl. 2¹: 263. 1878. Not *P. secundiflorus* Benth." Statement of type locality from Gray: "Mountains of Colorado, common at 8 or 9,000 feet." Specimens named by Gray seen; none designated as type, but name sufficiently definite.

Usually in gravelly soil, on hillsides and along streams, at altitudes of 1,400 to 2,800 (3,000) meters; Submontane and Montane zones; flowering from mid-June to late August. Foothills and lower slopes of mountains, descending usually along rivers into high plains northward, from southeastern Wyoming to southern Colorado, on both continental slopes.

WYOMING: Laramie: Cheyenne, *Nelson* 1997 (M).

COLORADO: Arapahoe: Littleton, *Eggleston* 11213 (U). Boulder: Boulder, *Pennell* 5845 (Y); Coal Creek; Eldorado Springs; Lyons (M); Sulphide (B, Y). Chaffee: Buena Vista, *Sheldon* (U, Y, Z); Granite (U); Mount Harvard (Y). Clear Creek:

Empire, *Patterson* 258 (A, F, M, P, Y); Georgetown (Y); Idaho Springs (Y) Costilla: Sangre de Cristo Creek, *Rydberg & Vreeland* 5631 (Y). Denver: Valverde, *Pennell* 5846 (Y). Douglas: *H. S. Smith* 5136 (Y); Elbert: Bijou Basin, *Jones* 155 (F). El Paso: Colorado Springs, *Shear* 4789 (U, Y); Garden of the Gods; Manitou (M, P, Y); Palmer Lake; South Cheyenne Canyon; Ute Pass (M). Fremont: Wilson Creek, *Brandegge* 419 (M). Gilpin: Central City (Y); Eldora to Baltimore, *Tweedy* 5714A (Y). Lake: Twin Lakes, *C. W. Derry* (F). Larimer: Dale Creek; Estes Park (M, U); Fort Collins, *Crandall* 1866 (Y); Laporte (Y); Pennocks (Y); Poudre Canyon (Y). Las Animas: Stonewall, *Beckwith* 157 (Y), 164 (Y); Trinidad (Y). Park: Como, *Shear* 4586 (Y); Webster Canyon (M). Teller: Florissant, *Ramaley* 1313 (B). Weld: Evans (Y); Windsor, *Pennell* 5863 (P, S, U, Y).

23. *Penstemon magnus* Pennell, sp. nov.

Stems several, 40 cm. tall, from a caudex, stout, glabrous, bluish glaucous; leaves light green, scarcely glabrous, obscurely veined, glabrous, those at the base of the stem with oblanceolate, obtusish to obtuse blades 7 to 8 cm. long, narrowed into scarcely defined petioles (bases of lowest leaves not meeting around stem), the largest leaves 12 cm. long and 1.4 cm. wide; thyrsus narrowly elongate, one-half the height of the plant, composed of 7 or 8 fascicles, each consisting of 2 short axillary branches, the pedicels equaling the peduncle; sepals 6 to 7 mm. long, narrowly ovate, acuminate, obscurely and finely ribbed, with white to pinkish, scarious, denticulate margin, glabrous; corolla about 25 to 27 mm. long, the tube and throat about 18 to 20 mm. long, the throat strongly inflated and rounded ventrally, the 2 posterior lobes about 6 to 7 mm. long, united and arched about one-half their length, the 3 anterior lobes slightly longer, united at base, the free portions widely spreading; corolla glabrous without and within, probably deep blue (not seen fresh); anther sacs divaricate, 2.3 to 2.5 mm. long, oblong, distinct, opening from the distal apex nearly throughout, glabrous (except for minute ciliation of suture); sterile filament shorter than the anterior pair, scarcely enlarged and slightly flattened distally, bearded on the posterior face distally with a few short yellow hairs; capsule 15 to 20 mm. long, ovate, acuminate, glabrous; seeds 3 to 4 mm. long, irregularly rectangular in outline, curved, the angles sharp, not winged, the surface very minutely alveolate-reticulate, dark brown, slightly glistening.

Type in the herbarium of the New York Botanical Garden, collected in low, open grounds, near Teller (North Park), Jackson County, Colorado, altitude 2,400 meters, in flower, July 30, 1884, by C. S. Sheldon (no. 90; distributed as *P. confertus caeruleo-purpureus* A. Gray).

Probably Montane Zone.

24. *Penstemon leiophyllus* Pennell, sp. nov.

Stems one or several, 15 to 60 cm. tall, from a short branched caudex, glabrous, glandular-puberulent in the inflorescence, slightly glaucous; leaves dull pale green, slightly glaucous, finely veined, acute, altogether 10 to 13 cm. long, 1.3 to 2 cm. wide, narrowed into petiole-like bases of about one-third the total length, the leaves of the stem smaller, clasping from a broadly rounded base (bases of opposite leaves meeting around stem), becoming reduced to small bracts through the inflorescence; thyrsus narrow, secund, less than one-half the height of the plant, composed of 5 to 15 fascicles, each consisting of 2 short axillary branches, their pedicels somewhat exceeding the peduncle; sepals 6 to 7 mm. long, lanceolate, acuminate, not veined, with obscure or no scarious margin, entire, glandular-puberulent; corolla 25 to 30 mm. long, the tube and throat 17 to 20 mm. long, the throat decidedly inflated and rounded ventrally, the 2 posterior lobes 8 to 10 mm. long, united and arched about two-thirds their length, projecting, the 3 anterior lobes equaling or exceeding the posterior

ones, united at base, the free portions widely spreading; corolla externally glandular-puberulent, within glabrous, blue; anther cells distinct, opening distally throughout, glabrous; sterile filament nearly equaling the anterior pair, scarcely enlarging distally, flattened, slightly bearded to glabrous on the posterior face distally; capsule ovate, acuminate, glabrous (not seen mature).

Type in the U. S. National Herbarium, no. 260622, collected at Mammoth Creek, Utah, altitude 2,400 meters, in flower, September 10, 1894, by M. E. Jones (no. 6026b; distributed as *P. glaber utahensis* S. Wats.).

"Gravelly slopes," at altitudes of 2,100 to 2,700 meters; probably Submontane Zone; flowering in early September. Mountains of southwestern Utah.

UTAH: Garfield: Panguitch Lake, *Jones* 6015ar (U), 6015as (U); Mammoth Creek, *Jones* 6026b (U). Washington: Pine Valley Mountains, *Purpus* 6203 (U); St. George (M).

25. *Penstemon laevis* Pennell, sp. nov.

Stems one or several 40 to 70 cm. tall, from a short branched caudex, glabrous throughout, glaucous; leaves pale dull green, somewhat glaucous, obscurely veined, glabrous, those at the base of the stem with narrowly obovate to ovate, obtuse (at times retuse, with or without a mucro) blades, altogether 10 to 15 cm. long, 2 to 3 cm. wide, narrowed into petiole-like bases one-third the total length, the stem leaves similar, smaller, clasping from a more or less broadly rounded base (bases of opposite leaves nearly or quite meeting around stem), becoming reduced and bractlike through the inflorescence; thyrsus narrow, secund, about one-half the height of the plant, composed of 9 to 18 fascicles, each consisting of 2 short axillary branches, their pedicels probably exceeding the peduncle; sepals 4 to 7 mm. long, broadly ovate, more or less abruptly acuminate, not veined, with relatively broad erose-denticulate scarious margin, glabrous; corolla 20 to 30 mm. long, the tube and throat 14 to 20 mm. long, the throat decidedly inflated and rounded ventrally, the 2 posterior lobes 6 to 10 mm. long, united and arched one-half their length, projecting, the 3 anterior lobes nearly equaling the posterior ones, united at base, the free portions spreading; corolla glabrous without and within, blue (not seen fresh); anther sacs widely divaricate, 1.8 to 2 mm. long, oblong-lanceolate, distinct, opening distally three-fourths their length, minutely puberulent; sterile filament shorter than the anterior pair, scarcely enlarging distally, flattened, bearded with yellow hairs on the posterior face near the apex; capsule not seen.

Type in the U. S. National Herbarium, no. 260632, collected in red sand at Springdale, Washington County, Utah, altitude 1,200 meters, in flower, May 17, 1894, by M. E. Jones (no. 5250, in part; distributed as *P. glaber* Pursh).

"Red sand," at altitudes of 1,000 to 1,700 meters; Lower Sonoran and Upper Sonoran zones; flowering from middle to late May. Southwestern Utah.

UTAH: Kane: Johnson, *Jones* 5289y (U); Kanab, *Jones* 5289x (U). Washington: Near Canaan Ranch, *Jones* 5262, in part (M); Rockville, *Jones* 5224v (U); Springdale, *Jones* 5250 (M, U).

26. *Penstemon wardii* A. Gray.

Penstemon wardii A. Gray, Proc. Amer. Acad. 12: 82. 1876. "Utah, near Glenwood, at 5,300 feet, L. F. Ward, in Powell's Expedition." Isotype, collected in flower, June 4, 1875, near Glenwood, Utah, at 1,560 meters altitude, *L. F. Ward* 162, seen in U. S. National Herbarium.

Penstemon glaber wardii Jones, Contr. West. Bot. 12: 62. 1908.

At an altitude of about 1,600 meters; Upper Sonoran or Submontane Zone; flowering in mid-June. Sevier County, central Utah.

UTAH: Sevier: 4 miles up Salina Canyon, *Jones* 5419b (U).

27. *Penstemon glaber* Pursh.

Penstemon glaber Pursh, Fl. Amer. Sept. 738. 1814. "In upper Louisiana. *Bradbury*. * * * v. s. in Herb. Bradbury." According to Bradbury (Travels, 319) "Alluvia of the Missouri, above the Big Bend," South Dakota. Isotype, labeled "Louisiana. Bradbury," seen in herbarium of the Academy of Natural Sciences of Philadelphia.

Penstemon eriantherus Nutt. (in Fraser's Cat. 1813, *nomen nudum*) Gen. Pl. 2: 52. 1818. "P. glabra Pursh * * * Hab. In arid soils near the confluence of Shian [Cheyenne] River," South Dakota.

Penstemon gordonii Hook. in Curtis's Bot. Mag. 73: pl. 4319. 1847. "For the opportunity of figuring this * * * species * * * I am indebted to Edward Leeds, Esq., of Manchester, who raised it from seeds given him by Mr. Shepherd of the Botanic Gardens, Liverpool, and which had been collected by Mr. Gordon in the valley of the Platte River, on the east side of the Rocky Mountains."

Gravelly or alluvial banks, at altitudes of 1,200 to 2,100 (3,150) meters; Subboreal (Submontane) Zone (probably rarely ascending to Alpine Zone); flowering from early June to early August. High plains and foothills in drainage of Missouri River, south to Albany County, Wyoming. North Dakota to western Nebraska and central Wyoming.

SOUTH DAKOTA: Custer: Custer, *Rydberg* 916, in part (U). Fall River: Edgemont, *Rydberg & Bessey* 4910 (F, Y). Lawrence: Deadwood, *Rydberg* 916, in part (Y); Nasby (Y); Spearfish Canyon (F). Meade: Fort Meade, *Forwood* 287 (U). Pennington: Rapid Creek, *Over* 1842 (U). County uncertain: "Hills of Shian River," *Geyer* 124 (U, Y).

NEBRASKA: Banner: Lawrence Fork, *Rydberg* 276 (U, Y). Dawes: Pine Ridge, *Webber* (Y). Morrill: West of Chimney Rock, *Engelmann* (M). Sioux: War Bonnet Canyon, *T. A. Williams* (Y).

WYOMING: Albany: McGill Ranch, *Nelson* 7457 (B). Crook: Devils Tower, *L. W. Carter* (Y); Sundance Mountain (F, M). Fremont: Birds Eye, *Nelson* 9352 (M, U, Y); North Fork of Wind River (U). Johnson: Mouth of Trabing Creek, *Willits* 408 (R). Niobrara: U L Ranch, *Knowlton* 152 (U, Y). Park: Needle Mountain, *Cary* 612 (U). Sheridan: Big Horn, *Tweedy* 2330 (Y), Dome Lake Road,¹ *Nelson* 8541 (R); headwaters of Tongue River (Y). Washakie: Head of Middle Fork of Powder River, *Goodding* 285 (F, M, Y). Weston: Stockade Beaver, *Nelson* 9487 (R).

28. *Penstemon alpinus* Torr.

Penstemon alpinus Torr. Ann. Lyc. N. Y. 1: 35. 1824. "Hab. with the preceding ["On James (=Pikes) Peak, * * * 10,000 feet above the level of the ocean, near the region of perpetual snow," collected in July, 1820, by Dr. Edwin James]." Type seen in herbarium of Columbia University at the New York Botanical Garden. Name unfortunate, as plant rarely reaches timber line and grows mostly upon the lower mountain slopes and foothills. Although it does occur on the middle slopes of Pikes Peak, it would appear more probable that Doctor James, in making his habitat note, confused this plant with the truly alpine *P. hallii*, so abundant above timber line on Pikes Peak; or quite possibly Torrey simply assumed that this came from the same altitudes as the plants which precede it in his report. The type, in accordance with Torrey's description, is a quite glabrous plant.

Chelone alpina Spreng. Syst. Veg. 4: Cur. Post. 235. 1827.

Penstemon glaber alpinus A. Gray, Proc. Amer. Acad. 6: 60. 1862-3.

Penstemon riparius A. Nels. Bull. Torrey Club 25: 379. 1898. "Collected at Laramie [Wyoming] by Mr. Elias Nelson, June 18, 1897, and fruited specimens later in the season. Type specimen in Herb. Univ. of Wyoming, no. 3185." Type seen in

¹ Stem pubescent: forma *pubicaulis* Pennell.

Rocky Mountain Herbarium. Here maintained as a puberulent to pubescent form, *P. alpinus* forma *riparius* (A. Nels.) Pennell (indicated in the following lists by an asterisk).

Penstemon oreophilus Rydb. Bull. Torrey Club 31: 642. 1905. "Colorado: Eldora to Baltimore, 1903, *Tweedy* 5711 (type)." Type seen in herbarium of the New York Botanical Garden.

Species variable in size, pubescence, width of leaves, shape and length of calyx lobes, pubescence on anther sacs, etc., and possibly to be considered a subspecies of the much more stable *P. glaber*.

Gravelly soil, at altitudes of 1,350 to 3,000 (3,600) meters; Submontane and Montane zones, ascending to Alpine; flowering from early June to late August. River banks in the high plains, slopes of foothills, and mountains, southeastern Wyoming to central Colorado.

WYOMING: Albany: Chug Creek, *Nelson* 7309 (M, U, Y); Dunn Ranch (Y); Laramie,* *E. Nelson* 3185 (R, Y); Laramie Peak* (U); Prayers Crossing* (U); Sibylee* (Y). Carbon: Fort Steele (R); Medicine Bow, *Goodding* 39 (M, U). Goshen: Fort Laramie, *Nelson* 9194 (R).

COLORADO: Boulder: Allenspark (B, R); Crescent (B); Eldora,* *Robbins* 2391 (B, R); Nederland* (B); Pine Cliff* (B); St. Vrain Creek* (B); Sugarloaf Mountain* (B); Ward,* *Osterhout* (Y). Clear Creek: Bard Creek (F); Deer Creek* (F); near Empire,* *Patterson* 256 (Y); near Georgetown* (F). Denver: Military Park (M); Valverde, *Pennell* 5825 (M, Y), 5842 (F, H, R, S, Y). El Paso: Bald Mountain (Y); Cheyenne Mountain (Y); Colorado Springs,* *Jones* 973 (F); Crystal Park (M, U, Z); Green Mountain Falls (U, Z); Manitou (Y); North Cheyenne Canyon, (Y); Pikes Peak (*Pennell* 6338, near Mountain View), *Pennell* 6320 (D, K, Y), 6321 (P, Y); Quartz Ridge (Y); South Cheyenne Canyon (Y); Ute Pass (M). Fremont: *Brandegge* (M). Gilpin: Central City* (Y); Eldora to Baltimore (Y); Mammoth Gulch (B); Tolland, *Pennell* 6374 (Y),* 6374A (Y), 6376 (Y). Jefferson: Bergen Park (M); Buffalo Creek Canyon, *Rusby* (Y); Golden, *Jones* 824 (B, Y); Morrison (A). Larimer: Estes Park*; Horsetooth Mountain,* *Cowen* 1807 (Y), 4201; Moraine Park*; Stove Prairie Hill* (Y). Saguache: Marshall Pass, *Baker* 869 (Y). Teller: Rosemont, *Blumer* (F). Weld: Evans, *Johnston* 641 (Y).

29. *Penstemon brandegei* Porter.

Penstemon cyananthus brandegei Porter; Port. & Coult. Syn. Fl. Colo. 91. 1874. "Sierra Mojado, Brandegge." Isotype seen in herbarium of the Missouri Botanical Garden. This differs from other specimens here associated with it in having the corolla more lanate within, and in having the sterile filament, at least in some flowers, bearded with a very few hairs. The name is here used for what is believed to be a definite species, although some specimens, including the type, appear to approach *P. alpinus*.

Penstemon brandegei Porter; Rydb. Mem. N. Y. Bot. Gard. 1: 343. 1900. As to synonymy; description compounded of this and *P. cyaneus*.

Probably in environments similar to those preferred by *P. alpinus*, at altitudes of 1,800 to 2,400 meters; Submontane Zone; flowering from late June to late July. Probably foothills and lower mountain slopes, perhaps descending to high plains, southeastern Colorado and northeastern New Mexico, on the Atlantic slope.

COLORADO: Fremont: Canyon City, *Brandegge* 930 (M). Las Animas: Fisher Peak (Y); Trinidad, *Beckwith* 160 (Y), 162 (Y); Wootton (Y).

30. *Penstemon saxosorum* Pennell, sp. nov.

Stems several, 10 to 80 cm. tall, from a short branched caudex, slender, glabrous, not or scarcely glaucous; leaves green, not or scarcely glaucous, glabrous, those at the base of the stem with lanceolate, obscurely acute blades 5 to 7 cm. long, narrowed

into indefinite petiole-like bases of nearly one-half the total length, those of the stem similar, narrowly to broadly lanceolate, clasping from a narrowed (or above widened) base, longer than the internodes, the largest 5 to 9 cm. long, 0.5 to 1.8 cm. wide; thyrsus narrowly elongate, strongly secund, nearly one-third the height of the plant, composed of 5 to 9 fascicles, each consisting of 2 short axillary branches, the longest pedicels equaling or exceeding the peduncle; sepals 5 to 7 mm. long, ovate, with a caudate tip sometimes nearly equaling the body, obscurely veined, with white to pinkish, scarious, more or less denticulate margin, finely glandular-puberulent; corolla 16 to 22 mm. long, the tube and throat 11 to 16 mm. long, the throat strongly inflated and rounded ventrally, the 2 posterior lobes 5 to 6 mm. long, united and arched one-third to one-half their length, projecting, the 3 anterior lobes slightly longer, united at base, the free portions widely spreading; corolla very sparsely glandular-puberulent externally, glabrous within, deep blue (not seen fresh); anther sacs widely divaricate, 1.2 to 1.4 mm. long, lanceolate, distinct, opening from distal apex throughout, pubescent on the side with short hairs; sterile filament about equaling the anterior pair, slightly enlarged distally, flattened, bearded on the posterior face distally with short yellow hairs; capsule not seen.

Type in the herbarium of the New York Botanical Garden, collected on rocky hillsides, Woods Creek, Albany County, Wyoming, in flower, July 3, 1903, by L. N. Goodding (no. 1428; distributed as *P. strictus* Benth.).

Rocky slopes, at altitudes of 2,500 to 2,800 meters; Montane Zone; flowering from early July to mid-August. Hills, mountain slopes, and mesas, southeastern Wyoming and northern and west-central Colorado; on both continental slopes.

WYOMING: Albany: Centennial Mountain, *Nelson* 8759 (F, M, U, Y); near Fox Park, *Nelson* 9060 (M); Cummins (M); Woods Creek, *Goodding* 1428 (A, B, M, P, U, Y). Carbon: Battle Lake, *Nelson* 4186 (R).

COLORADO: Delta: Oak Mesa, north of Hotchkiss, *Cowen* (Y). Jackson: Camp Creek, *Goodding* 1455 (B, M, U, Y); Spicer, *Goodding* 1507 (A, B, M, U, Y). Routt: Anita Peak, *Goodding* 1759 (A, B, M, P, U, Y); Hahns Peak, *Goodding* 1704 (B, R, U, Y), *Tweedy* 4299 (U, Y).

31. *Penstemon subglaber* Rydb.

Penstemon glaber utahensis S. Wats. in King, Geol. Expl. 40th Par. 5: 217. 1871. "Uinta Mountains, (Pack's cañon) Utah; 7,000 feet altitude [S. Watson] (771) [in 1869]." Isotype, collected July, 1869, seen in herbarium of Columbia University at the New York Botanical Garden.

Penstemon utahensis A. Nels. Bull. Torrey Club 26: 242. 1899. Not *P. utahensis* Eastw. 1893.

Penstemon subglaber Rydb. Bull. Torrey Club 36: 688. 1909. New name for *P. glaber utahensis* S. Wats.

Gravelly sagebrush slopes, at altitudes of 2,100 to 3,000 meters; Submontane and Montane zones; flowering from early July to early September. Foothills and lower slopes of the Teton and Wasatch ranges, western Wyoming to Sevier County, Utah.

WYOMING: Fremont: Wind River Mountains, *Forwood* (U). Lincoln: Headwaters of Cliff Creek (Y); Gros Ventre River, *Nelson* 3981 (R). Uinta: Evanston, *Pennell* 5940 (Y); Fort Bridger (A, P).

UTAH: Salt Lake: Near Salt Lake, *Stokes* (U). San Pete: Ephraim Canyon, *Tidestrom* 221 (U); Manti Canyon (M); Mount Pleasant (U). Sevier: Fish Lake, *Jones* 5717q (U). Summit: Peck Canyon, *Watson* 771 (U, Y). Utah: Soldier Summit, *Pennell* 6129 (D, F, K, P, S, Y).

32. *Penstemon uintahensis* Pennell, sp. nov.

Stems several, 10 to 20 cm. tall, from a short caudex, slender, glabrous, sparsely glandular-puberulent in the inflorescence, not glaucous; leaves green, not or scarcely

glaucous, very obscurely veined, glabrous, those at the base of the stem with narrow, oblanceolate, rounded but mucronately acute blades 3 to 5 cm. long and 0.6 to 0.8 cm. wide, narrowed into petiole-like bases of nearly one-half the total length, those of the stem similar, clasping from a narrowed base, smaller, becoming much reduced in the inflorescence; thyrsus narrow, strongly secund, raceme-like, nearly one-third the height of the plant, composed of 5 or 6 fascicles, each consisting of 2 short axillary branches, the pedicels equaling the peduncle; sepals 5 to 6 mm. long, broadly ovate, with a slightly defined short acute tip, apparently not veined, with broad, white to pinkish, strongly and irregularly denticulate margin, finely glandular-puberulent; corolla 18 to 20 mm. long, the tube and throat 12 to 13 mm. long, the tube broad, the throat inflated and rounded ventrally, the 2 posterior lobes 5 to 6 mm. long, united and arched about one-third their length, projecting, the 3 anterior lobes 6 to 7 mm. long, united at base, the free portions spreading; corolla externally sparsely glandular-puberulent, within glabrous, probably blue (not seen fresh); anther sacs widely divaricate, 1 to 1.2 mm. long, lance-ovate, distinct, opening from the distal apex throughout, pubescent on the side with short hairs; sterile filament apparently equaling the anterior pair, gradually enlarging distally, flattened, bearded on the posterior face distally with yellow hairs; capsule not seen.

Type in the herbarium of the New York Botanical Garden, collected on crest of mountains, Dyer Mine, Uinta Mountains, Uinta County, Utah, in flower, June 30, 1902, by L. N. Goodding (no. 1221; distributed as *P. hallii* A. Gray). Isotypes in herbarium of Field Museum of Natural History and U. S. National Herbarium.

Alpine Zone.

33. *Penstemon cyaneus* Pennell, sp. nov.

Stems several, 40 to 80 cm. tall, from a short stout caudex, glabrous throughout, not or slightly glaucous; leaves light green, not glaucous, obscurely veined, glabrous, those at the base of the stem with lanceolate acute blades 15 cm. long and 1 to 2 cm. wide, narrowed into petiole-like bases of about one-third the total length, those of the stem lanceolate, clasping from a narrowed (or, in the upper leaves, widened) base, the longest 6 to 10 cm. long, becoming much reduced in the inflorescence; thyrsus narrowly elongate, strongly secund, nearly one-half the height of the plant, composed of 7 to 12 fascicles, each consisting of 2 axillary branches; pedicels shorter than (or the longest exceeding) the peduncle; sepals 4.5 to 5 mm. long, broadly ovate to nearly orbicular, with an evident short-acuminate tip, finely veined in age, with very broad, white to bluish, irregularly denticulate, scarious margin, glabrous; corolla 27 to 30 mm. long, the tube and throat 19 to 21 mm. long, the tube narrow, the throat inflated and rounded ventrally, somewhat contracted to the orifice, the 2 posterior lobes 8 to 9 mm. long, united one-third their length, projecting, the 3 anterior lobes slightly longer, united and flattened for 4 mm., the free lobes spreading to deflexed; corolla glabrous without and within, (early changing from violet-pink to) deep sky blue, violet toward tube; anther sacs divaricate, 1.8 to 2 mm. long, lanceolate, distinct, opening from the distal apex two-thirds to four-fifths their length, violet-purple on the sides, pubescent on the side with short fine hairs; sterile filament shorter than or equaling the anterior pair, violet-blue, gradually enlarging distally, flattened, bearded on the posterior face distally with yellow hairs; capsule 12 to 15 mm. long, ovate, acuminate, glabrous; seeds 2 to 3 mm. long, irregularly quadrangular in outline, curved, the angles sharp, thin, not winged, the surface finely alveolate-reticulate, brown, glistening.

Type in the herbarium of the New York Botanical Garden, collected in dry sagebrush, along railroad north of Ashton, Fremont County, Idaho, altitude of 1,560 to 1,590 meters, in flower and immature fruit, July 9, 1915, by F. W. Pennell (no. 6046).

Open sagebrush slopes, frequently gravelly or rocky, at altitudes 1,500 to 2,000 (3,000) meters; Submontane Zone; flowering mid-June to early August. Foothills

and high plains, Park County and Yellowstone National Park, Wyoming, and adjacent Montana (in Madison Valley) to Blaine County, Idaho.

WYOMING: Yellowstone National Park: Near Mammoth Hot Springs, *Mearns* 496 (U), 1079 (Y), 1216 (Y), 2638 (U), *A. & E. Nelson* 5633 (M, U, Y), *Pennell* 6034 (H, P, Y); Spring Creek (R); Witch Creek (F); Yellowstone Lake (M, U).

IDAHO: Bingham: "Big Butte Station," *Palmer* 234 (U), 235 (U), 474 (U). Fremont: Ashton, *Pennell* 6046 (Y); Mount Chauvet, *Rydberg & Bessey* 4912 (F, U, Y), 4913 (Y); St. Anthony, *Merrill & Wilcox* 821 (U, Y).

34. *Penstemon cyananthus* Hook.

Penstemon cyananthus Hook. in Curtis's Bot. Mag. 75: pl. 4464. 1849. "It is * * * an inhabitant of * * * the upper valleys of the Platte River in the Rocky Mountains, where seeds were collected by Mr. Burke. These seeds were reared by Messrs. Lucombe, Pince and Co., in whose Exeter nursery the plants flowered beautifully * * * in May 1849." Type not seen or verified.

Penstemon glaber cyananthus A. Gray, Proc. Amer. Acad. 6: 60. 1862-63.

Varies in width of leaf and size of flowers. Southward (at Mount Nebo) specimens occur with more scarious calyx lobes, possibly approaching *P. cyananthus longiflorus*.

Mostly gravelly or rocky soil, sagebrush slopes, and openings in mountain woods, at altitudes of (1,300) 1,500 to 3,000 meters; Submontane and Montane zones, at times descending and ascending from these; flowering from late May to mid-August. Hills and mountains from southwestern Montana southward to Piute County, Utah; abundant in the Wasatch Range.

WYOMING: Uinta: Evanston, *Pennell* 5898 (Y), 5900 (F, P, Y); Medicine Butte, *Pennell* 5907 (Y).

IDAHO: Bear Lake: Fish Haven Canyon, *Mulford* 230 (M, Y). Fremont: Ashton, *Pennell* 6046B (Y).

UTAH: Cache: Cache Junction (M, U); Logan, *C. P. Smith* 1613 (R), 2201 (Y). Davis: Farmington Canyon; Kaysville, *Armstrong* 328 (Y). Juab: Mount Nebo, *Goodding* 1104 (F, U, Y). Morgan: Devils Slide, *Pennell* 5943 (B, H, M, R, U, Y). Piute: Mountains north of Bullion Creek, *Rydberg & Carlton* 7113, in part (Y). Salt Lake: Alta; Altus, *Pennell* 5962 (H, P, R, S, Y), 5967 (Y; albino); east of Barclay, *Pennell* 5956 (M, Y); South Fork of Big Cottonwood Creek, *Pennell* 5976 (Y); City Creek Canyon (Y); Dry Canyon (Y); Emigration Canyon, *Pennell* 5984; benches near Salt Lake City (Y); Silver Lake, *Pennell* 6085 (Y); above Sulphur Baths (F, M). Sevier: Belknap, *Stokes* (U, Y). Summit: Echo, *Pennell* 5935 (D, U, Y). Tooele: Ophir City,¹ *E. S. Blackwell* (P). Utah: Rock Canyon, east of Provo, *Pennell* 6123 (F, Y). Weber: Ogden, *Meehan* (A).

34a. *Penstemon cyananthus subglaber* (A. Gray) Pennell.

Penstemon fremontii subglaber A. Gray, Syn. Fl. 2¹: 262. 1878. "Idaho," in mountains near Fort Hall, *Burke*. Type in Gray Herbarium, verified by Mr. J. F. Macbride, who in a letter says of it, "The leaves are narrower than usual in *P. cyananthus*." A corolla sent me shows it to be this form.

Stems puberulent below, frequently for most of their length; leaves prevailing lanceolate, the largest stem leaves 6 to 7 cm. long, 1 to 1.5 cm. wide, more densely puberulent; corolla about 20 mm. long; capsule 8 to 10 mm. long. Otherwise as in the species.

Dry sagebrush slopes, at altitudes of 1,500 to 2,100 meters; Submontane Zone; flowering in July and early August. Hills and lower mountain slopes, western Wyoming, eastern Idaho, and northwestern Utah. Probably grades into the species. WYOMING: Lincoln: Spread Creek, *Tweedy* 231 (Y).

¹ More puberulent on stem, although glabrous above.

IDAHO: Bannock: Pocatello, *Pennell* 6061 (M, R, Y), 6062 (F, H, U, Y), 6066 (P, Y).

Fremont: Ashton, *Pennell* 6046a (Y); near Fall River (M).

UTAH; Box: Holstein Ranger Station, Minidoka National Forest, *J. H. Kroencke* 22548 (U. S. Forest Service Herb.).

34b. *Penstemon cyananthus longiflorus* Pennell, subsp. nov.

Stems puberulent, at least below, to nearly or quite glabrous; calyx lobes broader, with more evidently scarious margin and relatively shorter tips; corolla 25 to 30 mm. long, with longer tube at base; inflorescence more secund. Otherwise as in the species.

Type in the herbarium of Columbia University at New York Botanical Garden, collected at Beaver City, Utah, in flower, by Edward Palmer (no. 376; distributed as *P. glaber cyananthus*).

Southwestern Utah. Probably Submontane Zone; flowering in late July.

UTAH: Beaver: Beaver City, *Palmer* 376 (M, Y). Millard: Filmore National Forest, *L. Tuttle* 25318 (U. S. Forest Service Herb.). Piute: Near Marysvale, *Rydberg & Carlton* 7083 (Y).

35. *Penstemon scariousus* Pennell, sp. nov.

Stems several, 20 to 30 cm. tall, from a branched caudex, sparsely glandular-puberulent in the inflorescence, dull or slightly glaucous; leaves apparently dull green and somewhat glaucous, obscurely veined, glabrous, those at the base of the stem with broadly oblanceolate, acute blades 6 to 7 cm. long, narrowed into petiole-like bases about two-thirds the length of the blade, those of the stem similar, lanceolate, clasping (bases of the upper meeting around stem), the largest 7 to 9 cm. long, 0.9 to 1.1 cm. wide; thyrsus narrow, racemiform, strongly secund, about one-third the height of the plant, composed of 4 to 6 fascicles, each consisting of 2 axillary ascending branches; pedicels shorter than or equaling the peduncle; sepals 8 to 12 mm. long, ovate-lanceolate, with a caudate tip nearly or quite equaling the length of the body, obscurely or not veined, proximally with a conspicuous broad, white, scarious, slightly denticulate margin, sparsely and minutely glandular-puberulent; corolla about 30 mm. long, the tube and throat 20 mm. long, the tube narrow, the throat inflated and rounded ventrally, the 2 posterior lobes 10 mm. long, united and arched two-fifths to one-half their length, the free portions projecting, the 3 anterior lobes slightly longer, united at base, the free portions spreading; corolla externally glabrous, within glabrous or slightly pubescent over bases of anterior lobes, blue (not seen fresh); anther sacs widely divaricate, 1.8 mm. long, oblong-lanceolate, distinct, opening from the distal apex for three-fourths to four-fifths their length, densely pubescent on the side with loose white hairs, their length not exceeding the width of the sacs; sterile filament shorter than the anterior pair, gradually enlarging distally, flattened, bearded on the posterior face distally with scattered (or at apex more dense) short yellow hairs; capsule not seen.

Type in the U. S. National Herbarium, no. 507700, collected on aspen slopes, east of Musinia Peak, Wasatch Mountains, headwaters of Muddy Creek, Utah, altitude 2,700 meters, in flower, September 12, 1907, by Ivar Tidestrom (no. 568).

Also collected in the Uinta Mountains by H. D. Longille (no. 120; U, Y).

Montane Zone.

36. *Penstemon garrettii* Pennell, sp. nov.

Stems several, 20 to 40 cm. tall (very sparsely glandular-puberulent in the inflorescence), from a stout branched caudex, dull or slightly glaucous; leaves apparently dull green and somewhat glaucous, obscurely veined, glabrous, those at the base of the stem with lanceolate acute blades 6 to 7 cm. long, narrowed into petiole-

like bases about one-half their length, those of the stem similar, narrowly lanceolate, clasping, the largest 6 to 10 cm. long, 0.7 to 0.9 cm. wide; thyrsus narrowly racemiform, strongly secund, less than one-half the height of the plant, composed of 7 to 10 fascicles, each consisting of 2 erect axillary branches; longer pedicels exceeding the peduncle; sepals 4 to 6 mm. long, ovate, with an acuminate tip about one-half the length of the body, obscurely veined in fruit, with conspicuous broad, white, scarious, coarsely and irregularly denticulate margin, finely and sparsely glandular-puberulent; corolla about 20 mm. long, the tube and throat 15 mm. long, the tube narrow, the throat inflated and rounded ventrally, the 2 posterior lobes 5 mm. long, united and arched one-half their length, apparently spreading, the 3 anterior lobes slightly longer, united at base, the free portions spreading; corolla glabrous without and within, probably blue (not seen fresh); anther sacs widely divaricate, 1.2 to 1.4 mm. long, oblong-lanceolate, distinct, opening from the distal apex nearly throughout, pubescent on the side with loose white hairs, their length not exceeding the width of the sacs; sterile filament shorter than the anterior ones, gradually enlarging distally, flattened, bearded on the posterior face distally with scattered (or at apex dense) short yellow hairs; capsule 8 to 9 mm. long, ovate, acuminate, glabrous, brownish; seeds about 2 mm. long, irregularly quadrangular in outline, curved, the angles sharp, not winged, the surface finely alveolate-reticulate, brown, slightly glistening.

Type in the herbarium of the New York Botanical Garden, collected in crevices in travertine rock in exposed places, "Hot Pots," near Midway, Wasatch County, Utah, in flower and fruit, July 6, 1905, by E. C. Carlton and A. O. Garrett (no. 6697). Isotypes in herbarium of Academy of Natural Sciences of Philadelphia, Rocky Mountain Herbarium, and U. S. National Herbarium.

At altitudes of 1,900 to 2,100 meters; probably Submontane Zone; flowering in early July. Eastern slope of the Wasatch Range, northeastern Utah.

UTAH: Utah: Price Canyon at Kyune, *Jones* 5603g (U). Wasatch: Near Midway, *Carlton & Garrett* 6697 (A, R, U, Y); "Hot Pots," July 4, 1905, *Garrett* 1329 (A).

37. *Penstemon cyanocaulis* Payson.

Penstemon cyanocaulis Payson, Bot. Gaz. 60: 380. 1915. "Collected on high, dry mesas near Naturita [Montrose County, Colorado], May 25, 1914, where it is rather infrequent; alt. about 5,800 ft.; [Edwin Payson] no. 348." Type seen in Rocky Mountain Herbarium.

Dry, rocky or gravelly soil, at altitudes of 1,600 to 2,000 meters; Upper Sonoran Zone; flowering in late May. Mesas and foothills, drainage of Grand River, southwestern Colorado and southeastern Utah.

COLORADO: Montrose: Naturita, *Payson* 348 (F, M, R); Paradox, *Walker* 166 (U, Y).

UTAH: San Juan: Near Little Springs, western slope of La Sal Mountains, *Rydberg & Garrett* 8540 (Y).

38. *Penstemon caryi* Pennell, sp. nov.

Stem 10 cm. tall, from a caudex, slender, glabrous throughout, purplish glaucous; leaves apparently pale green, obscurely veined, glabrous, those at the base of the stem with narrowly lanceolate, obtuse blades 7 cm. long, narrowed into petiole-like bases about one-third the total length, those of the stem similar, nearly linear, the largest 4 to 5 cm. long, 0.2 to 0.3 cm. wide; thyrsus racemiform, strongly secund, one-third the height of the plant, composed of 4 fascicles, each consisting of 2 axillary ascending branches; longest pedicels equaling the peduncle; sepals 5 mm. long, ovate, with a long acuminate tip nearly equaling the length of the body, with white scarious margin, glabrous; corolla 15 mm. long, the tube and throat 11 mm. long, the throat inflated and rounded ventrally, the 2 posterior lobes 4 mm. long, united and

arched for one-third their length, projecting, the 3 anterior lobes 5 mm. long, united at base, the free portions spreading; corolla glabrous without and within, probably blue (not seen fresh); anther sacs widely divaricate, 1.4 to 1.5 mm. long, oblong-lanceolate, distinct, opening from the distal apex throughout, pubescent on the side with loose white hairs, their length not exceeding the width of the sac; sterile filament shorter than the anterior pair, gradually enlarging distally, flattened, bearded on the posterior face distally with scattered (or at apex dense) short yellow hairs; capsule not seen.

Type in the U. S. National Herbarium, no. 858840, collected in the Bighorn Mountains, Wyoming, altitude 2,400 meters, in flower, June 4, 1910, by Merritt Cary (no. 504).

Probably Submontane Zone.

39. *Penstemon strictiformis* Rydb.

Penstemon strictiformis Rydb. Bull. Torrey Club 31: 642. 1905. "Colorado: Mancos, 1898, Baker, Earle & Tracy 76 (type)." Type seen in herbarium of the New York Botanical Garden.

At altitudes of 1,900 to 2,100 meters; probably Submontane Zone; flowering from late June to July. Foothills, valley of San Juan River in southwestern Colorado.

COLORADO: Archuleta: Pagosa Springs, B. H. Smith (A). La Plata: Durango, Eastwood (U). Mineral: Wagonwheel Gap, A. D. McNair 16718 (U. S. Forest Service Herb.). Montezuma: Mancos, Baker, Earle & Tracy 76 (F, M, Y), Eastwood (Y).

40. *Penstemon strictus* Benth.

Penstemon strictus Benth. in DC. Prodr. 10: 324. 1846. "In montibus Scopulosis ad fontes fl. Sweetwater (Frémont!) * * * (v. in herb. Torrey)." Type, labeled as collected August 7, 1842, seen in herbarium of Columbia University at the New York Botanical Garden. On August 7 Frémont was about South Pass, Sweetwater County, Wyoming, in the region assigned by Bentham as that of the type.

Variable, especially southward, in amount and length of hairs on the anther sacs and on the sterile filament, and in the length and acumination of the sepals. Northward more frequently with nearly linear leaves (this the typical state), although rarely such forms occur southward. Pubescence on petioles and bases of stems more pronounced southward in the La Sal Mountains, Utah.

Sagebrush and wooded slopes, at altitudes of 1,800 to 2,800 (3,000) meters; Submontane and Montane zones; flowering from mid-June to early August. Foothills, mountain slopes, and mesas, southern Wyoming, through Colorado to northern New Mexico. On both continental slopes.

WYOMING: Albany: Centennial, Nelson 3314 (M, U, Y); Cummins (M, U, Y); Laramie (Y); Sheep Mountain (F); Sybille Creek (U). Carbon: Encampment, Tweedy 4297 (U, Y); Hayden Forest (U); Hilton's; near T B Ranch (R). Fremont: Near South Pass, Frémont (Y). Sweetwater: Leucite Hills, Merrill & Wilcox 676 (U, Y), 705 (U, Y).

COLORADO: Archuleta: Arboles, Baker 602 (F, M, U, Y); Pagosa Springs (A). Conejos: South of Antonito, Crandall 4196 (Y). Costilla: Near Grayback, Rydberg & Vreeland 5629 (Y), 5630 (R, Y); Sangre de Cristo Creek (Y). Delta: Tongue Creek, Mesa Grande, Purpus 257 (F). Eagle: Gypsum Creek Canyon, Crandall (M); Wolcott. El Paso: Palmer Lake, Mrs. Osterhout 286. Garfield: Glenwood Springs, Pennell 6146 (B, D, F, H, Y), 6154 (R, Y), 6155 (U, Y), 6167 (Y). Grand: Coulter; Hot Sulphur Springs, Ramaley & Robbins 3612 (B). Gunnison: Gunnison, Pennell 6289 (M, Y); near Mount Carbon (U); Sapinero, Pennell 6271 (H, Y). Jackson: Michigan Creek; Pearl (U, Y); Walden, Goodding 1500 (A, B, M, P,

U, Y). La Plata: Durango (U); La Plata River, *Baker, Earle & Tracy* 660 (F, M, Y); Parrote City (M). Mineral: Wagon Wheel Gap, *B. H. Smith* (A). Montezuma: Chicken Creek, *Baker, Earle & Tracy* 354 (F, M, R, U, Y); Dolores (U); Mancos (Y). Montrose: Cerro Summit (Y); Cimarron, *Pennell* 6253 (D, K, M, P, S, Y); Tabeguache Basin (F, M). Ouray: Ouray, *Pennell* 6179 (A, R, U, Y), 6243 (F, Y); Ridgway (U). Rio Blanco: Meeker, *Robbins* 7143 (B); Rio Blanco (B). Routt: Elk River (Y); Hayden (F, Y); Steamboat Springs, *Crandall* (U); Yampa. Saguache: Sargents, *Pennell* 6303 (Y). Summit: Mount Guyot, *J. P. Anderson* (M).

UTAH: Grand: La Sal Mountains, *Purpus* 7008 (M, U). San Juan: Ridge north of Brumley Creek, *Rydberg & Garrett* 8935 (U, Y); Geyser Canyon (U, Y). Uinta: Carter Dugway, *Goodding* 1406 (R).

40a. *Penstemon strictus angustus* Pennell, subsp. nov.

Stem usually puberulent, at least below; basal leaves narrowly lanceolate, 5 to 10 cm. long, 0.5 to 1.1 cm. wide, puberulent, glaucous; stem leaves linear or nearly so; corolla 25 to 32 mm. long (frequently larger than in the species). Otherwise as in the species.

Type in the herbarium of the New York Botanical Garden, collected at Piedra, Colorado, in flower, by C. F. Baker (no. 604; distributed as *P. strictus* Benth.).

Sagebrush slopes, at altitudes of 2,000 to 2,400 meters; Submontane Zone, but probably descending into Upper Sonoran; flowering in early July. Mesas and foothills, southwestern Colorado and southeastern Utah.

COLORADO: Archuleta: Piedra, *Baker* 604 (M, U, Y). Delta: Coal Springs Ranger Station (Y). La Plata: Durango, *T. S. Parsons*. Montezuma: Mancos, *Baker, Earle & Tracy* 405 (F, M, U, Y).

UTAH: San Juan: Along Brumley Creek, *Rydberg & Garrett* 8879, in part (Y), 8880 (Y).

41. *Penstemon comarrhenus* A. Gray.

Penstemon comarrhenus A. Gray, Proc. Amer. Acad. 12: 81. 1876 "Common in Utah, especially southward, coll. by Gordon, E. W. Emerson, Mrs. Thompson, Siler and recently by L. F. Ward." According to a memorandum by Mr. J. F. Macbride the specimen of Gordon, of which but a fragment is in the Gray Herbarium, is *P. strictus* Benth. This fails to answer the original description of *P. comarrhenus*. Of the remaining specimens cited, that of Ward was evidently particularly studied, and, as this fully answers the description, it may be considered as the type. Isotype seen in herbarium of Columbia University at the New York Botanical Garden.

Rocky or gravelly sagebrush slopes, at altitudes of 1,400 to 2,600 (3,000) meters Upper Sonoran and Submontane zones; flowering from late June to early August. Mesas in Colorado drainage and westward, western Colorado and central Utah.

COLORADO: Delta: Cedar Edge, *Baker* 245 (M, U, Y). Garfield: Glenwood Springs, *Pennell* 6157 (B, K, S, Y), 6159 (A, D, F, H, M, P, R, U, Y); Newcastle (B). Montezuma: Mesa Verde, *F. E. Lutz* (Y). Montrose: Naturita (F, M, P); Paradox, *Walker* 130 (U, Y). San Miguel: Norwood Hill, *Walker* 429 (U).

UTAH: Beaver: Beaver City, *E. Palmer* 375 (U, Y). Carbon: Castle Gate (M, U, Y); Helper, *Pennell* 6141 (Y), 6142 (H, Y). Garfield: Aquarius Plateau, *Rydberg & Carlton* 7383 (U, Y), *Ward* 462 (F, M, U); Panguitch Lake (U). Grand: Near Wilson Mesa, *Rydberg & Garrett* 8417 (Y). La Sal Mountains, *Purpus* 6613 (M, U). Kane: Asa's, *Jones* 6030q (U). Piute: Marysvale, *Rydberg & Carlton* 7030 (Y). San Juan: Monticello, *Rydberg & Garrett* 9159 (Y). Sevier: Fish Creek Canyon, *Garrett* 2503 (M, Y); Fish Lake. Wayne: Mount Ellen, *Jones* 5684as (U).

42. *Penstemon grandiflorus* Nutt.

Penstemon grandiflorus Nutt. in Fraser's Cat. 1813. "It was first met with near the confluence of the River Platte [with the Missouri], from whence it continues to the Andes. [Nuttall.]"

Penstemon bradburii Pursh, Fl. Amer. Sept. 738. 1814. "*P. grandiflorum* Fraser, Catal. 1813." Description, but no habitat given. Probable isotype seen in herbarium of the Academy of Natural Sciences of Philadelphia.

Chelone bradburii Steud. Nom. Bot. 186. 1820-24.

Chelone grandiflora Spreng. Syst. Veg. 2: 813. 1825.

Plains, at altitudes of 900 to 1,200 meters; Upper Sonoran and Subboreal zones; flowering from late May to late June. High plains, within the Missouri drainage, occurring probably rarely through eastern Wyoming and eastern Colorado.

SOUTH DAKOTA: Custer: Hermosa, *Rydberg* 915 (U). Fall River: Hot Springs, C. S. *Williamson* (A). Meade: Fort Meade, *Forwood* 288 (U). Stanley: Fort Pierre, *Hayden* (A).

NEBRASKA: Cherry: Fort Niobrara, *T. E. Wilcox* (Y). Dawes: Belmont (Y); Crawford, *MacDougal* 118 (Y). Thomas: Halsey, *Krautter* (P).

WYOMING: Sheridan: Little Goose Grade, *Nelson* 2333, in part (U, Y).

COLORADO: "Eastern Colorado," *W. J. Laybourn* (M).

43. *Penstemon secundiflorus* Benth.

Penstemon secundiflorus Benth. in DC. Prodr. 10: 325. 1846. "In montibus Scopulis (Frémont!) * * * (v. in herb. Torrey)." Type seen in herbarium of Columbia University at the New York Botanical Garden. Lacks satisfactorily opened flowers, but leaves and young flowers indicate the plant here considered. The specimen is labeled "Fremont-2nd. Exped.," "named by Bentham"; unfortunately the number of collection is lost, but Frémont upon his second expedition was in eastern Colorado.

Sagebrush slopes, granitic soil, at altitudes of 1,500 to 2,700 meters; Submontane Zone (perhaps entering lower Montane Zone); flowering from late May to early June. Foothills and outlying hills in high plains, often abundant, from Albany County, Wyoming, southward on the eastern continental slope to Bernalillo County, New Mexico.

WYOMING: Albany: Crow Creek (Y); Laramie, *Pennell* 5876 (Y); Sand Creek (Y); Table Mountain (M, U).

COLORADO: Boulder: Boulder, *Pennell* 5833 (K, P, S, Y); Miramonte (B); Nederland (B); St. Vrain Creek (B); Valmont (F). Chaffee: Near Buena Vista (U, Y); Salida, *Pennell* 6309 (D, R, Y). Clear Creek: Clear Creek Canyon (F, U); Empire, *Patterson* 254 (A, F, M, P, Y); Georgetown (M). Denver: Denver, *Pennell* 5843 (Y); Valverde, *Pennell* 5839 (B, Y). El Paso: Crystal Park (Y); Eastonville (U); Garden of the Gods, *Pennell* 5779 (Y), 6316 (Y); Manitou, *Pennell* 5782 (Y), 5789 (U, Y); North Cheyenne Canyon, *Pennell* 5773 (D, F, H, M, R, Y), 5776 (Y); Pring (U); South Cheyenne Canyon, *Pennell* 5793 (Y), 6342 (F, H, M, P, U, Y); Ute Pass (M); Palmer Lake, *Pennell* 5808 (Y). Gilpin: Lake Ranch (Y); Rollinsville, *Overholts* (M, Y). Grand: Middle Park, *W. A. Henry* (F, M). Jackson: Camp Creek, *Goodding* 1457 (B, M, P, U, Y). Jefferson: West of Arena, *Pennell* 6346 (Y); Golden, *Pennell* 5817 (Y), 6383 (Y); Morrison, *Pennell* 5823 (U, Y). Larimer: Estes Park (U); Fort Collins (Y); Fossil Creek (B); Horsetooth Mountain, *Pennell* 5860 (D, F, H, Y); La Porte (Y); Owl Canyon, *Pennell* 5868 (A, M, R, Y); Ten-mile Creek (B). Park: South Park, *Wolf* 300 (A, U, Y). Weld: Carr, *Johnston* 3 (M).

43a. *Penstemon secundiflorus lavendulus* Pennell, subsp. nov.

Stems 20 to 40 cm. tall, relatively slender; basal leaves lanceolate; stem leaves more or less narrowly lanceolate, acuminate from a not conspicuously widened base; inflorescence one-half the height of the plant; sepals about 4 mm. long, ovate, acute to acuminate, with scarious, white to pink margins; corolla smaller and narrower than in the species, 15 to 20 mm. long, a paler lavender-pink to lavender-blue; capsule not seen. Otherwise nearly as in the species.

Type in the herbarium of the New York Botanical Garden, collected on bluff of Baculite Mesa, altitude 1,530 meters, six miles northeast of Pueblo, Pueblo County, Colorado, in flower, June 7, 1915, by F. W. Pennell (no. 5739). Isotypes in U. S. National Herbarium, herbarium of Missouri Botanical Garden, Gray Herbarium, and Rocky Mountain Herbarium.

Upper Sonoran Zone.

44. *Penstemon osterhoutii* Pennell, sp. nov.

Stems one to several, 40 to 80 cm. tall, from a short branched caudex, glabrous, slightly pale or bluish glaucous; leaves thickened, greenish, slightly glaucous, evidently reticulate-veined, glabrous, those at the base of the stem with ovate acute blades 7 to 9 cm. long, narrowed into margined petioles 3 to 5 cm. long, those of the stem clasping (bases of opposite leaves meeting around stem), lanceolate-ovate to ovate, acuminate from a widened base, the largest mostly 6 to 9 cm. long, 3 to 4 cm. wide; thyrsus narrowly elongate, nearly one-half (or more) the height of the plant, composed of 5 to 10 fascicles, each consisting of 2 short axillary branches, their pedicels shorter or longer than the peduncle; sepals 7 to 8 mm. long, ovate, acuminate, fine-ribbed, with broad, white to pink, scarious margin, glabrous; corolla 20 mm. long, the tube and throat 13 mm. long, the throat inflated and rounded ventrally, the 2 posterior lobes 7 mm. long, united and arched one-third to nearly one-half their length, the 3 anterior slightly longer, 7 mm. wide, united about two-fifths their length, all the free portions widely spreading; corolla externally glabrous, within lanate-pubescent over the base of the anterior lobes, glabrous elsewhere, blue or bluish (not seen fresh); anther sacs widely divaricate (explanate), 1 to 1.2 mm. long, oblong, distinct, with short line of contact, opening throughout, the suture glabrous; sterile filament 14 to 15 mm. long, slightly exserted, flat, much enlarged distally, recurved at apex, very densely bearded on the posterior face distally with golden-yellow hairs; capsule 10 to 13 mm. long, ovate, acuminate, glabrous, pale brown; seeds 3 to 4 mm. long, irregularly lanceolate-curved in outline, the angles sharp, semiwinged, the surface alveolate-reticulate, cinnamon-brown, glistening.

Type in the herbarium of the New York Botanical Garden, collected at Glenwood Springs, Garfield County, Colorado, in flower, May 24, 1911, by G. E. Osterhout (no. 4575).

Loamy sagebrush slopes, at altitudes of 1,700 to 2,100 meters. Submontane Zone; flowering from late May to late June. Valley of Grand River in Eagle and Garfield counties, Colorado.

COLORADO: Eagle: State Bridge, *Osterhout* 4213. Garfield: Glenwood Springs, *Osterhout* 4575 (Y), 4702 (Y), *Pennell* 6158 (A, D, F, H, M, R, S, U, Y), 6165 (F, Y), 6170 (B, K, P, Y), 6172 (Y).

45. *Penstemon versicolor* Pennell, sp. nov.

Stems several, 20 to 35 cm. tall, from a short branched caudex, glabrous, bluish glaucous; leaves thickened, dull green, glaucous, obscurely reticulate-veined, glabrous, those at the base of the stem with obovate acutish blades 3 to 4 cm. long, narrowed into scarcely defined petioles (less than 1 cm. long), those of the stem cordate-clasping (opposite leaves meeting), ovate, acute, from a cordate base, the largest

mostly 3 to 5 cm. long, 2 to 2.5 cm. wide; thyrsus narrowly elongate, one-half (or more) the height of the plant, composed of 6 to 12 fascicles, each consisting of 2 short axillary branches, their pedicels longer than or equaling the peduncle; sepals 5 to 6 mm. long, ovate, acutish to acute, obscurely and finely ribbed, with white to pinkish scarious margins, glabrous; corolla 20 mm. long, the tube and throat 14 mm. long, the throat inflated and rounded ventrally, the 2 posterior lobes 6 mm. long, united and arched one-third their length, the three anterior lobes slightly longer, united at base, all the free portions widely spreading; corolla externally glabrous, within lanate-pubescent with few hairs over the base of anterior lobes or glabrous, pink, changing to blue, within throat with more or less conspicuous red-purple lines; anther sacs widely divaricate (explanate), 1 mm. long, oblong, slightly confluent, with short line of contact, opening throughout, the suture glabrous; sterile filament 14 to 15 mm. long, slightly exserted, flat, much enlarged distally into a broad white obtuse expansion, recurved at the apex, bearded on the posterior face distally with two lines of short dense golden-yellow hairs; capsule 10 to 12 mm. long, ovate, acuminate, glabrous, brown; seeds 4 to 5 mm. long, irregularly lanceolate in outline, nearly straight, irregularly convolute, the angles sharp, semiwinged, the surface alveolate-reticulate, cinnamon-brown, glistening.

Type in the herbarium of the New York Botanical Garden, collected on high prairie (mesa) east of Pueblo, Pueblo County, Colorado, in flower, June 5, 1915, by F. W. Pennell (no. 5732). Isotypes in the U. S. National Herbarium and in the Rocky Mountain Herbarium.

Loam sagebrush mesas, at altitudes of 1,400 to 1,700 meters; Upper Sonoran Zone; flowering in early June. Upper valley of Arkansas River, Colorado.

COLORADO: Fremont: Canon City, *Brandege* (M). Pueblo: East of Pueblo, *Pennell* 5732 (R, U, Y); west of Pueblo, *Pennell* 5734 (D, F, H, M, P, U, Y), 6315 (B, D, F, H, K, M, P, R, S, U, Y).

46. *Penstemon lentus* Pennell, sp. nov.

Stems several, 20 to 30 cm. tall, from a relatively long, branched caudex, glabrous, pale or bluish glaucous; leaves strongly thickened, pale or dull green, glaucous, in age evidently reticulate-veined, glabrous, those at the base of the stem with more or less broadly oval, obtuse to acute blades 2.5 to 4 cm. long, rather abruptly narrowed into strongly margined petioles 1.5 to 2.5 cm. long, those of the stem clasping (bases of opposite leaves meeting around stem), lanceolate to ovate, acute or obtuse with a mucro, the largest mostly 3 to 7 cm. long, 1 to 2 cm. wide; thyrsus narrowly elongate, one-third to one-half the height of the plant, composed of 4 to 8 fascicles, each consisting of 2 short axillary branches, the pedicels shorter or longer than the peduncle; sepals 3 to 6 mm. long, ovate, acute to acuminate, fine-ribbed, with evident narrow, white to pinkish, slightly sinuate, scarious margins, glabrous; corolla 18 to 20 mm. long, the tube and throat 13 to 14 mm. long, the throat somewhat inflated and rounded ventrally, the 2 posterior lobes 5 to 6 mm. long, united and arched one-fourth their length, the 3 anterior lobes slightly longer, 4 to 6 mm. wide, united at the base, all free portions more or less spreading; corolla externally glabrous, within slightly lanate-pubescent over the bases of the anterior lobes, glabrous elsewhere, blue or bluish (not seen fresh); anther sacs widely divaricate (explanate), 0.9 to 1 mm. long, oblong, distinct, with relatively long line of contact, opening from the distal apex throughout, the suture glabrous; sterile filament slightly exserted, flat, slightly enlarged distally, recurved at apex, densely bearded on the posterior face toward the apex with relatively short, yellow hairs; capsule 8 mm. long, ovate, acuminate, glabrous; seeds 2 to 3 mm. long, curved in outline, the angles sharp, the surface dull brown.

Type in the herbarium of the New York Botanical Garden, collected at Arboles, Colorado, in flower, June 3, 1899, by C. F. Baker (no. 596; distributed as *P. acumi-*

natus Dougl.). Isotypes in herbarium of Missouri Botanical Garden and U. S. National Herbarium.

Dry hills and mesas, at altitudes of 1,800 to 2,100 meters; Upper Sonoran Zone; flowering in late May and early June. Valleys of the San Juan and Dolores rivers, southwestern Colorado and southeastern Utah.

COLORADO: Archuleta: Arboles, *Baker* 596 (M, U, Y). Montezuma: Mancos, *Eastwood* (Y). Montrose: Naturita, *Payson* 340 (F, M).

UTAH: San Juan: Monticello, *Rydberg & Garrett* 9209, in part (Y).

47. *Penstemon pachyphyllus* A. Gray.

Penstemon nitidus major Benth. in DC. Prodr. 10: 323. 1846. "In montibus Scopulosis (Frémont!). (v. in herb. Torrey.)." Type, from "Hillsides of Du Chene Fork," Wasatch County, Utah, collected, in flower, May 31, 1844, by J. C. Frémont (Second Expedition, no. 485), seen in herbarium of Columbia University at the New York Botanical Garden. Type bears also the annotation "'*P. pachyphyllus*' Gray mss."

Penstemon acuminatus congestus Jones, Proc. Calif. Acad. II. 5: 714. 1895. "[*M. E. Jones*] no. 5262. May 19, 1894, near Canaan Ranch, Utah, 5,000° alt., in sand." *Jones* 5262, seen only in the herbarium of the Missouri Botanical Garden, includes specimens of two species, *P. laevis* and *P. pachyphyllus*. The latter, fitting the description and being the same as the other collections cited, is taken as typical.

Penstemon pachyphyllus A. Gray; Rydb. Fl. Rocky Mts. 770, 1066. 1917. Based upon *P. nitidus major* Benth.

Stems several, 30 to 60 cm. tall, from a short branched caudex, glabrous, pale or bluish glaucous; leaves strongly thickened, pale green, glaucous, in age evidently reticulate-veined, glabrous, those at the base of the stem with oval obtuse (with a mucro) blades 5 to 7 cm. long, narrowed into strongly margined petioles 3 to 5 cm. long, those of the stem clasping (bases of opposite leaves meeting around stem), lanceolate-oval to ovate, mostly 3 to 5 cm. long, 2 to 4 cm. wide; thyrsus narrowly elongate, one-third to one-half the height of the plant, composed of 5 to 10 fascicles, each consisting of 2 short axillary branches, their pedicels shorter or longer than the peduncle; sepals 5 mm. long, ovate, acute, fine-ribbed, with evident white to pinkish, slightly sinuate, scarious margin, glabrous; corolla 15 to 18 mm. long, the tube and throat 10 to 12 mm. long, the throat somewhat inflated and rounded ventrally, the 2 posterior lobes 5 to 6 mm. long, united and arched one-third their length, the 3 anterior lobes slightly longer, 4 to 5 mm. wide, united at base, all free portions widely spreading; corolla externally glabrous, within lanate-pubescent over the base of the anterior lobes, glabrous elsewhere, blue or bluish (not seen fresh); anther sacs widely divaricate (explanate), 1 to 1.2 mm. long, oblong, distinct, with relatively long line of contact, opening from the distal apex throughout the suture, glabrous; sterile filament 10 to 12 mm. long, slightly exserted, flat, slightly enlarged distally, recurved at apex, densely bearded on the posterior face distally with apparently dull yellow hairs; capsule 10 to 14 mm. long, ovate, acuminate, glabrous, pale brown; seeds 2 to 3 mm. long, thick-crescentic, curved in outline, the angles sharp, semiwinged, the surface alveolate-reticulate, cinnamon-brown, glistening.

Loamy sagebrush slopes, at altitudes of 1,500 to 2,600 meters; Upper Sonoran and Submontane zones; flowering from late May to late June. Colorado Valley from Duchesne River southward to northern Arizona.

UTAH: Beaver: Frisco, *Jones* 1812 (F, Y). Carbon: Helper, *Pennell* 6143 (H, U, Y); Price, *Pennell* 6145 (P, Y). Sevier: Near Richfield, *Ward* 166 (U); head of Salina Canyon, *Jones* 5441a (M, R, Y). Wasatch: "Hillsides of Du Chene Fork," *Frémont* 485 (Y). Washington: Near Canaan Ranch (near Rockville), *Jones* 5262, in part (M).

48. *Penstemon haydeni* S. Wats.

Penstemon haydeni S. Wats. Bot. Gaz. 16: 311. 1891. "First collected by Dr. F. V. Hayden, in the Laramie Mountains of Wyoming, during some one of his early surveys, without flowers or fruit. * * * Rediscovered during the past season, in flower and fruit, by Mr. H. L. Webber, on the Dismal River in Thomas County, Nebraska, about a hundred miles west of the 100th meridian." Description evidently based upon specimen of H. L. Webber, collected in 1891, which is therefore taken as type; cotype, collected July 12, 1889, seen in herbarium of Columbia University at New York Botanical Garden. The plant of Hayden I have not seen; it is possibly not of this species.

Dry, sandy soil, at altitudes of about 800 meters; Subboreal Zone; flowering from early June to early July. Sandhills of western Nebraska.

NEBRASKA: Cherry: 20 miles south of Valentine, *Bates* (Y). Thomas: Near Plummer Ford, Dismal River, *Rydberg* 1506 (U, Y); Dismal River, *Webber* (Y); Halsey, *Krautter* (P).

49. *Penstemon angustifolius* Nutt.

Penstemon angustifolius Nutt. (in Fraser's Cat. 1813, *nomen nudum*), Pursh, Fl. Amer. Sept. 738. 1814. "In Upper Louisiana, *Bradbury* * * * v. s. in herb. *Bradbury*." According to *Bradbury* (Travels, 318), "Near the Mintaree village," North Dakota. Pursh's description possibly included also *P. gracilis*, but Nuttall, under account of *P. coeruleus*, designated which is to be considered typical. Isotype, collected by *Bradbury* in Louisiana, seen in herbarium of Academy of Natural Sciences of Philadelphia.

Penstemon coeruleus Nutt. Gen. Pl. 2: 52. 1818. "Hab. On the plains of the Missouri, near Fort Mandan and the Indian towns."

Chelone angustifolia Steud. Nom. Bot. 186. 1820-4. Not *C. angustifolia* H. B. K. 1817.

Chelone coerulea Spreng. Syst. Veg. 2: 813. 1825.

Varies irregularly, the leaves linear to lanceolate, the bracts conspicuously elongate to short, the stem and leaves glabrous to finely puberulent.

Prairies, at altitudes of 800 to 2,300 meters; Subboreal, southward into Upper Sonoran Zone; flowering from mid-May to early July. High plains, westward to base of foothills in eastern Wyoming and Colorado. North Dakota and eastern Wyoming to southeastern Colorado; including subspecies to northern New Mexico.

SOUTH DAKOTA: Fall River: Hot Springs, *Rydberg* 917 (U, Y). Stanley: For Pierre, *Hayden* (A). Todd: Rosebud, *E. J. Wallace* (R). Washabaugh: Bear Creek, *Over* 2083 (U).

NEBRASKA: Cherry: Fort Niobrara, *T. E. Wilcox* (Y); Merriman. Deuel: *Rydberg* 275, in part (Y). Hooker: Mullen, *Rydberg* 1284 (U). Keith: Ogallala, *Pennell* 6402 (H, K, R, U, Y). Lincoln: Hershey; North Platte, *Pennell* 6407 (A, F, M, Y). Scotts Bluff: Eaglenest Butte, *Hayden* (Y). Sheridan: Near Hay Springs, *MacDougal* 103 (Y). Thomas: Halsey (P); Thedford, *Rydberg* 1284 (U, Y).

KANSAS: County uncertain: Kansas National Forest, *d'Allemand* (U. S. Forest Service Herb.).

WYOMING: Albany: Laramie, *Pennell* 5872 (Y); Lookout (M); near Prayers Crossing (U); Red Buttes (B, Y); Sand Creek (Y). Goshen: Fort Laramie, *Nelson* 8304 (U, Y). Laramie: Cheyenne (U); Corlett, *Johnston* 1 (M).

COLORADO: Boulder: White Rocks, *Ramaley* (B). Cheyenne: Arapahoe, *Mrs. S. B. Walker* (F). Denver: Denver, *Wolf* 291 (F, U). El Paso: Garden of the Gods, *Pennell* 5780 (Y); Manitou, *Pennell* 5787 (Y), 5788; Nob Hill, *Pennell* 5796 (Y); North Cheyenne Canyon, *Pennell* 5772 (D, Y); South Cheyenne Canyon, *Pennell* 6341 (D, P, Y). Gilpin: Tolland ("along R. R. track, probably introduced"),

Ramaley 10497 (B). Larimer: "The Glades," *Pennell* 5865 (Y); Fossil Creek (B); Livermore (B); Owl Canyon, *Pennell* 5869 (Y); Red Mountain, (B); Ten-mile Creek (B). Las Animas: Stonewall, *Beckwith* 165 (Y); Trinidad (Y). Lincoln: Hugo, *C. D. Marsh* (U; approaching *P. angustifolius caudatus*). Sedgwick: Julesburg, *Pennell* 6399 (R, U, Y). Weld: Crow Creek (U); Evans (Y); Greeley (Y); Pawnee Buttes (B); Peckham (M); Windsor, *Pennell* 5848 (M, Y), 5849 (Y).

49a. *Penstemon angustifolius caudatus* (Heller) Rydb.

Penstemon caudatus Heller, Minn. Bot. Stud. 2: 34. 1898. "The type is our no. 3580, collected May 26, 1897, at Barranca, Taos County [New Mexico], altitude 6,900 feet. It is very abundant in open grassy, sandy soil, about Barranca station, growing in large patches." Probable isotype, *Heller* 3581, seen in herbarium of the New York Botanical Garden.

Penstemon angustifolius caudatus Rydb. Bull. Torrey Club 33: 151. 1906.

Prairies, at altitudes of 1,000 to 2,300 meters; Upper Sonoran Zone; flowering from mid-May to early June. High plains, valley of the Arkansas River in southeastern Colorado and in western Kansas, to Taos County, northern New Mexico. Variable and very inconstantly distinguished; perhaps a robust form, rather than a geographical subspecies of *P. angustifolius*.

KANSAS: Wallace: Wallace, *W. A. Kellerman* (U, Y).

COLORADO: Bent: Rule Creek, *Osterhout* 4869. El Paso: Colorado Springs, *Eggleston* 11155 (U). Fremont: Canon City, *Pennell* 6311 (H, R, U, Y). Huerfano: Near La Veta, *Rydberg & Vreeland* 5642 (Y), 5643 (Y), 5644 (Y), 5645 (Y); Ojo (Y); Walsenburg (Y). Las Animas: Wootton, *Rusby* (Y). Otero: La Junta, *Osterhout* 3963. Prowers: 25 miles south of Lamar, *Osterhout* 5071. Pueblo: Beulah (B, R); Pueblo, *Pennell* 5738 (Y), 6314 (D, F, M, Y). Yuma: Wray, *Osterhout* 5257.

50. *Penstemon arenicola* A. Nels.

Penstemon arenicola A. Nels. Bull. Torrey Club 25: 280. 1898. "Abundant in the sand dunes in the hill region of the Red Desert, near Point of Rocks [Wyoming]. Collected June 1, 1897. * * * Type specimen in herb. University of Wyoming, no. 3090." Isotype seen in herbarium of Columbia University at the New York Botanical Garden.

Sandy hills and plains, at altitudes of 1,900 to 2,100 meters; Upper Sonoran Zone; flowering from early to middle June. Red Desert of southwestern Wyoming.

WYOMING: Sweetwater: Point of Rocks, *Nelson* 3090 (M, Y), *Pennell* 5889 (D, F, P, U, Y); 15 miles north of Point of Rocks, *Merrill & Wilcox* 693 (U); southeast of Red Desert, *Pennell* 5881 (H, M, R, Y); Steamboat Mountain, *Nelson* 7050 (R). Uinta: Carter (R); Fort Bridger, *Nelson* 4598 (R); Henrys Fork (R).

51. *Penstemon nitidus* Dougl.

Penstemon nitidus Dougl.; Benth. in DC. Prodr. 10: 323. 1846. "In collibus siccis ad flumina Saskatchewan, Assinaboin et Red River (Douglas! Richardson!) * * * (v. s.)." Type not seen or verified.

Prairies, at an altitude of 1,500 meters; Subboreal Zone; flowering in June. High plains, entering northern Wyoming in valley of Tongue River. Manitoba to Alberta and northern Wyoming.

WYOMING: Sheridan: Jackson Creek (R); Little Goose Grade, *Nelson* 2333, in part (M); *Tweedy* 47 (Y), 2332 (Y), 3417 (Y). Sweetwater: South Butte, "Thirteen Mile," *Nelson* 3554 (R).

52. *Penstemon cyathophorus* Rydb.

Penstemon cyathophorus Rydb. Bull. Torrey Club 31: 643. 1905. "Colorado: Pearl, 1901, *Tweedy* 4307 (type)." Type seen in herbarium of the New York Botanical Garden.

"Meadows," "sagebrush", at altitudes of 2,400 to 2,600 meters; probably Montane Zone; flowering from early June to late July. Middle and North Park, northern Colorado and adjacent southeastern Wyoming.

WYOMING: Carbon: "Hiltons" ("North Park in edge of Wyoming"), *Osterhout* 986. COLORADO: Grand: Sulphur Springs, *Clements* (Y), *Osterhout* 2975, 3255. Jackson: Grizzly Creek (Y); Pearl, *Tweedy* 4307 (U, Y).

53. *Penstemon coloradoensis* A. Nels.

Penstemon coloradoensis A. Nels. Bull. Torrey Club 26: 355. 1899. "Of this species I have before me specimens from two collections made near Mancos, Colorado, by Messrs. Baker, Earle and Tracy, 1898, and distributed as *P. caespitosus* Nutt." Type (no. 70, collected in flower June 23, 1898) seen in the Rocky Mountain Herbarium. The second collection referred to (no. 27, collected in flower June 21, 1898) is *P. xylus* A. Nels.

Sagebrush plains, at altitudes of 900 to 2,100 meters; Upper Sonoran Zone; flowering from mid-June to early July. San Juan Valley of southwestern Colorado to southern Utah, northwestern New Mexico, and northern Arizona.

COLORADO: La Plata: Durango, *Crandall* 1826 (B, F, R, U, Y). Montezuma: Dolores (Y); Mancos, *Baker, Earle & Tracy* 70 (F, M, R, U, Y).

UTAH: Washington: Pine Valley (U. S. Forest Service Herb.); St. George, *Palmer* (Y).

53a. *Penstemon coloradoensis sileri* (A. Gray) Pennell.

Penstemon linarioides sileri A. Gray, Syn. Fl. 2¹: 270. 1870. "S. Utah, *Siler*." Probable isotype, from Osmer, *Siler* 90, seen in herbarium of the Missouri Botanical Garden.

Probably only a form of *P. coloradoensis*.

Southern Utah; flowering from middle to late June.

UTAH: Kane: Sink Valley, *Jones* (M, U).

54. *Penstemon exilifolius* A. Nels.

Penstemon exilifolius A. Nels. Bull. Torrey Club 28: 230. 1901. "The latter [*A. Nelson* 7460] is taken as the type and is from Halleck Cañon [Wyoming], July 6, 1900." Isotype seen in herbarium of the New York Botanical Garden.

Dry, stony plateaus and hillsides, at altitudes of 2,200 to 2,700 meters; probably Montane Zone; flowering from early July to early August. Southeastern Wyoming and northeastern Colorado.

WYOMING: Albany: Cummins (R); Halleck Canyon, *Nelson* 7460 (B, M, U, Y); Laramie Hills, *E. Nelson* 52 (Y); Laramie Plains, *Nelson* 419 (M, U, Y); Red Buttes; Sheep Mountain, *Goodding* 2086 (U, Y); near Upper Laramie River, *Frémont 2nd Exped.* 533 (Y); west of Sherman (M).

COLORADO: Larimer: Medicine Bow Mountains, *Crandall* (Y).

55. *Penstemon laricifolius* Hook. & Arn.

Penstemon laricifolius Hook. & Arn. Bot. Beech. Voy. 376. 1841. "Hab. Snake Fort, Snake Country, [a friend of] *Mr. Tolmie*." Isotype, labeled "Snake Country," and probably from southeastern Idaho, seen in herbarium of Columbia University at New York Botanical Garden.

Penstemon exilifolius desertus A. Nels. Bull. Torrey Club **28**: 231. 1901. "On dry sandstone ridges * * * Point of Rocks [Wyoming], Jun. 12, 1900 [A. Nelson] no. 7160." Isotype seen in herbarium of New York Botanical Garden.

Dry sandstone ridges, at altitudes of 2,100 to 2,400 meters; Submontane Zone; flowering from mid-June to early July. Interior low ridges, central and southwestern Wyoming and (probably) southeastern Idaho.

WYOMING: Fremont: Big Sandy (U); Birds Eye, *Nelson* 9363 (M, U, Y); Camp Stambaugh (U); Wind River Mountains (U). Hot Springs: Owl Creek, *Parry* 206, in 1873 (A, F, Y). Natrona: Bessemer, *Goodding* 181 (M, U, Y); Garfield Peak (R); Platte River Canyon (M). Sweetwater: Leucite Hills (U); Point of Rocks, *Nelson* 4748 (R), 7160 (B, F, M, U, Y), *Pennell* 5888 (U, Y).

IDAHO: "Snake Country, [a friend of] *Tolmie*" (Y).

56. *Penstemon ambiguus* Torr.

Penstemon ambiguus Torr. Ann. Lyc. N. Y. **2**: 228. 1828. "Hab. Near the Rocky Mountains [*E. P. James* in 1820]." Type, collected probably in eastern Colorado, northeastern New Mexico, or northwestern Texas, seen in herbarium of Columbia University at the New York Botanical Garden.

Leiostemon purpureus Raf. Atl. Journ. **1**: 145. 1832. Based upon "*Penstemon ambiguum*" Torr.

Penstemon ambiguus foliosus Benth. in DC. Prodr. **10**: 321. 1846. "In montibus Scopulosis (Fremont!). (v. in herb. Torrey.)." Type, *Frémont* 623; according to his notes, collected "On the high level prairie, Jul. 7, 1844," probably in Cheyenne County, Colorado; seen in herbarium of Columbia University at the New York Botanical Garden.

Leiostemon ambiguus Greene, Leaflets **1**: 223. 1906.

Prairies, at altitudes of 800 to 1,300 meters; Upper Sonoran Zone; flowering from mid-June to mid-July. High plains, on both continental slopes, western Oklahoma and eastern Colorado to southwestern Utah and Chihuahua.

COLORADO: Cheyenne (?): *Frémont* (Y). Logan: Sterling, *Osterhout* 990. Otero: Rocky Ford, *Berg* 1836 (Y). Yuma: Wray, *Osterhout* 3984, 4332 (Y); Yuma.

UTAH: San Juan: Near Bluff, *Rydberg & Garrett* 9934 (Y). Washington: St. George, *Palmer* 379 (F, Y).

57. *Penstemon deustus* Dougl.

Penstemon deustus Dougl.; Lindl. Bot. Reg. **16**: pl. 1318. 1830. "P. deustum Douglas in herb. Hort. Soc. Native of Northwest America, where it was found by Mr. Douglas on scorched, rocky plains, in the interior. Our drawing was made in the Garden of the Horticultural Society in September, 1829." Type not seen or verified, but description evidently of plant here considered.

Dry, rocky soil, at altitudes of 1,500 to 2,200 meters; Submontane Zone; flowering from early to late July. Bighorn County, Wyoming to Washington, southward to Nevada and northern California.

WYOMING: Bighorn: *Worthley* 35 (U). Park: "Stinkingwater," *Parry* 207 (A, F, M, Y). Yellowstone National Park: Near Excelsior Geyser (F); Golden Gate, *Pennell* 6029 (D, H, P, S, Y); Junction Butte (U); Mammoth Hot Springs (F, M, U, Y); Obsidian Creek (R); Silver Gate (Y); head of Swan Lake Valley (U); divide between Snake River and Yellowstone Lake (U).

IDAHO: Bingham: Big Butte Station, *Palmer* 481 (U). Bonneville: Idaho Falls, *Palmer* 372 (U). Fremont: Ashton, *Pennell* 6045 (F, M, R, U, Y); St. Anthony (U, Y).

58. *Penstemon watsoni* A. Gray.

Penstemon fremontii parryi A. Gray in King, Geol. Expl. 40th Par. **5**: 218. 1871. "Colorado (Parry). Toyabe, Diamond and East Humboldt Mountains, Nevada;

(6-7,000 feet altitude) [*S. Watson*] (773)." Specimen collected in Colorado by C. C. Parry in 1862 and labeled *P. fremontii* Torr. & Gray, doubtless type or isotype, seen in U. S. National Herbarium.

Penstemon watsoni A. Gray, Syn. Fl. 2¹: 267. 1878. "Mountains of W. Colorado, Utah, and Nevada (*Fremont, Parry, Watson, Wheeler, Vasey, Ward, &c.*), to borders of Arizona, *Palmer*." Isotype, labeled as from Austin, Nevada, collected in flower, July, 1868, *S. Watson* 773, seen in herbarium of the New York Botanical Garden.

Penstemon phlogifolius Greene, Leaflets 1: 164. 1906. "Castle Gate, Utah, M. E. Jones, 1894, sheet 237290, U. S. Herb." Type, *M. E. Jones* 5486s, collected in flower, June 23, 1894, seen in U. S. National Herbarium.

Sagebrush slopes, among junipers, summits of mesas, at altitudes of 1,800 to 2,600 (2,700) meters; Submontane and Upper Sonoran zones; flowering from mid-June to early July. Valley of Grand River in Colorado, westward across the Great Basin to southern Idaho, central Nevada, and northern Arizona. Eastern (our) plants, usually with more cuspidate calyx teeth, are perhaps of subspecific rank.

WYOMING: Uinta: Fort Bridger, *Porter* (Y).

COLORADO: Eagle: Red Cliff; *Wolcott, Osterhout* 2109 (R). Garfield: Glenwood Springs, *Pennell* 6168 (U, Y); Grizzly, *Pennell* 6162 (A, B, D, M, Y). Grand: Sulphur Springs, *Ramaley & Robbins* 3611 (B, R).

UTAH: Carbon: Castle Gate, *Jones* 5486s (M, U, Y), *Pennell* 6140 (D, F, H, K, P, R, S, U, Y). Iron (or Beaver): Buckskin Valley, *Engelhardt & Doll*. San Pete: Mountains east of Gunnison (Twelve Mile Creek Canyon), *Ward* 280 (M, U). Sevier: Fish Lake, *Rydberg & Carlton* 7633 (Y); canyon east of Glenwood (Brine Creek Canyon above Kings Meadows), *Ward* 308 (F, M, U); head of Salina Canyon, *Jones* 5433 (F, M, U, Y). Utah: Provo, *Coulter* (U).

IDAHO: Fremont: 12 miles east of Beaver, *Redeker* 58 (R).

59. *Penstemon procerus* Dougl.

Penstemon procerus Dougl.; Graham, Edinb. N. Phil. Journ. 7: 348. 1829. "Raised at the Botanic Garden, Edinburgh, from seeds gathered by Mr. Drummond." Drummond's specimens would be from Alberta or Saskatchewan.

Penstemon micranthus Nutt. Journ. Acad. Phila. 7: 45. 1834. "Hab. In the valleys of the Rocky Mountains, near the sources of the Columbia [*N. B. Wyeth*]." Type, collected by Wyeth, July 11, in Fremont County, Idaho, or in Lincoln County, Wyoming, seen in herbarium of Academy of Natural Sciences of Philadelphia.

Lepteiris parviflora Raf. New Fl. 2: 73. 1836. (Type of genus *Lepteiris* Raf.) "Oregon * * * collected by Wyeth." Type apparently the same as of *P. micranthus* Nutt.

Penstemon confertus violaceus Trautv. Bull. Acad. St. Pétersb. 5: 344. 1839. "Found by Mr. Drummond on the Rocky Mountains." Based upon *P. procerus* Dougl.

Penstemon confertus coeruleo-purpureus A. Gray, Proc. Amer. Acad. 6: 72. 1862-63. "Plains of the Saskatchewan, and through the Rocky Mountains to the coast range of Oregon and British Columbia." Aggregate name to go with earliest described component, *P. procerus* Dougl.

Penstemon confertus procerus Coville, Contr. U. S. Nat. Herb. 4: 169. 1893.

Penstemon procerus micranthus Jones, Bull. Univ. Mont. Biol. Ser. 15: 45. 1910.

Moist to dryish grassy slopes, at altitudes of (1,500) 1,900 to 3,200 (3,900) meters; Montane and Subalpine zones, rarely ascending to Alpine or descending to Submontane; flowering from mid-June to mid-August. Widespread through the Rockies, south to Chaffee County, Colorado. Manitoba to British Columbia, south in the mountains to Colorado, Utah, and Washington.

WYOMING: Carbon: Copperton, *Tweedy* 4303 (U, Y); Hilton's. Fremont: Leckie, *Merrill & Wilcox* 578 (U, Y), 581 (U, Y), 719 (U); Union Pass (Y). Johnson:

Eastern slope of Bighorn Mountains, *Tweedy* 3415 (Y). Lincoln: Cokeville¹ (R); La Barge (U); Mount Leidy (Y); Upper Hoback Basin, *C. C. Curtis* (Y). Sheridan: Big Horn, *Tweedy* 2329 (Y). Sweetwater: Bush Ranch, *Nelson* 7107, in part (Y). Uinta: Evanston, *T. A. Williams* (U). Yellowstone National Park: Devils Cut (U); along Madison River, *Pennell* 5991 (Y); near Mammoth Hot Springs (A, M); Middle Gardiner Falls (F); Swan Lake, *Pennell* 6036a (Y); Wraith Falls (M, U).

IDAHO: Fremont: Canyon Creek, *Merrill & Wilcox* 881, in part (U, Y).

COLORADO: Boulder: Caribou, *Penard* 526 (Y). Chaffee: Mount Harvard, *Clements* (Y). Clear Creek: Bard Creek Valley,¹ *Patterson* 255 (F, M, P, Y); Graymont;¹ Mount Lincoln¹ (U). Gilpin: Central City, *Scovell* (E). Jackson: Big Creek Park; near Pinkhampton (Y, Z); Walden,¹ *Goodding* 1502, in part (A, B, M, P, U, Y). Lake: Leadville (A, M, U); Mount Massive (F); Tennessee Pass, *D. A. Saunders* (Y); Twin Lakes (F, U). Larimer: Cameron Pass; Chambers Lake, *Crandall* (Y). Park: Between Como and Boreas,¹ *Cowen* 389 (M, U); South Park, *Wolf* (F, U). Summit: Breckenridge,¹ *Mackenzie* 145 (A, M); Farnham (M).

UTAH: Salt Lake: Altus (F); Clayton Peak (M, U); Gogorza, *Pennell* 5964 (F, H, R, U, Y); Silver Lake, *Pennell* 6083 (M, Y), 6105 (D, P, S, Y). Summit: Parley Park, *Watson* 783 (Y).

59a. *Penstemon procerus aberrans* (Jones) A. Nels.

Penstemon confertus aberrans Jones, Proc. Calif. Acad. II. 5: 715. 1895. "[*M. E. Jones*] no. 560li. July 6, 1894, Soldier Summit, Utah, 7,300° alt., in gravel." Type seen in U. S. National Herbarium.

Penstemon procerus aberrans A. Nels. Bot. Gaz. 54: 146. 1912.

Gravelly soil, low sagebrush and meadows, at altitudes of 2,100 to 2,700 meters; Submontane and Montane zones; flowering from early July to early August. Wasatch Mountains of central Utah.

UTAH: Garfield: Aquarius Plateau, at head of Poison Creek, *Rydberg & Carlton* 7377 (Y), 7436 (Y). Sevier: Fish Lake, *Jones* 5740 (F, M, U), *Rydberg & Carlton* 7511 (U, Y), *Ward* 342 (F, M, U). Utah: Soldier Summit, *Jones* 560li, in part (U), *Pennell* 6130 (F, H, M, R, Y).

59b. *Penstemon procerus pulvereus* Pennell, subsp. nov.

Sepals lanceolate-attenuate, more or less caudate, with relatively conspicuous scarious margins, more or less densely canescent-puberulent; corolla densely lanose within. Otherwise as in the species, with which it frequently grows and evidently intermingles.

Type in the herbarium of the New York Botanical Garden, collected on moist meadow knolls, north of Swan Lake, Yellowstone National Park, Wyoming, in flower, July 7, 1915, by F. W. Pennell (no. 6036).

Grassy soil, meadows; at altitudes of 1,900 to 2,700 meters; Montane and Submontane zones; flowering from mid-June to mid-August. Mountains, southwestern Montana, western Wyoming, and southeastern Idaho.

WYOMING: Fremont: Union Pass, *Nelson* 833 (F, M, U). Lincoln: Buffalo Fork, *Tweedy* 228 (Y); head of Clarks Fork (U); Gros Ventre River (U). Sweetwater: Bush Ranch, *Nelson* 7107, in part (M, U). Yellowstone National Park: Devils Cut (U); Gardiner River (Y); Mammoth Hot Springs (M, U); near Swan Lake, *Pennell* 6036 (F, H, K, M, P, R, U, Y); Wraith Falls (M, Y); mouth of Yellowstone Lake, *Pennell* 6013 (A, D, R, S, Y).

Approaching *P. rydbergii*.

IDAHO: Fremont: Beaver Canyon, *Shear* 3033 (Y), 3053 (Y); Canyon Creek (U, Y); Island Park (F).

60. *Penstemon rydbergii* A. Nels.

Penstemon rydbergii A. Nels. Bull. Torrey Club 25: 281. 1898. "It was met with in abundance in an aspen grove in a draw in the Laramie Hills [Wyoming], July 1, 1897. Type specimen collected at Green Top [Albany County], in Herb. University of Wyoming, A. Nelson no. 3214." Isotype seen in herbarium of Columbia University at the New York Botanical Garden.

Penstemon erosus Rydb. Bull. Torrey Club 28: 28. 1901. "Colorado: Indian Creek Pass, 1900, *F. K. Vreeland*, 615 (type)." Type seen in herbarium of the New York Botanical Garden.

Penstemon lacerellus Greene, Leaflets 1: 161. 1906. "At Sargents', southern Colorado, 5 July, 1901, C. F. Baker, n. 352, as in U. S. Herb." Type seen in U. S. National Herbarium.

Penstemon latiusculus Greene, Leaflets 1: 161. 1906. "Stony ground along stream banks at Gunnison, Colo., 24 July, 1901, C. F. Baker, n. 588, as in U. S. Herb." Type seen in U. S. National Herbarium.

Intergrades with *P. procerus*; apparently nearest to *P. procerus aberrans*, from which, however, its larger flowers and more lacerate sepals distinguish it.

Moist grassy flats or slopes, aspen thickets, at altitudes of (2,100) 2,200 to 3,000 (3,300) meters; Submontane and Montane zones; flowering from late June to mid-August. Mountains, eastern Wyoming, southward on both continental slopes, through most of Colorado.

WYOMING: Albany: Antelope Basin (M, U, Y); Centennial, *Nelson* 8725, in part (M, U, Y); Chug Creek (M, U, Y); Green Top, *Nelson* 3214 (M, Y); Nashs Fork (Y); head of Pole Creek (Y); Sherman (F). Carbon: Hayden Forest, *Eggleston* 11242 (U). Johnson: Crazy Woman Creek, *T. A. Williams* (U). Laramie: Horse Creek, *E. Nelson* 80 (Y).

COLORADO: Chaffee: Salida, *Clements* 253 (Y). Clear Creek: Grays Peak (U); Mount McClellan, *E. L. Greene* (E). Delta: On Tongue Creek, Mesa Grande, *Purpus* 303 (F). Grand: Middle Park, *W. A. Henry* (M). Gilpin: Central City (Y); Eldora to Baltimore (Y); Tolland, *Pennell* 6371 (Y), 6377 (M, U, Y). Gunnison: Gunnison, *Baker* 588 (M, U, Y), *Pennell* 6288 (D, R, Y); Parlin (Y); Pitkin (Y); Sapinero (B). Huerfano: Indian Creek Pass, *Vreeland* 615. Larimer: Mountains, *Osterhout* 57. Mineral: Wagon Wheel Gap, *B. H. Smith* (A, F). Montezuma: Chicken Creek, *Baker, Earle & Tracy* 658 (F, M, U, Y). Ouray: Engineer Mountain, *Purpus* 706 (F). Park: Como, *Crandall* 1795 (Y); Saguache: Marshall Pass (U, Y); Sargents, *Baker* 352 (M, U, Y), *Pennell* 6293 (A, D, H, K, Y), 6301 (Y). Summit: Robinson, *Shear* 3329 (U, Y).

UTAH: Uinta: Youngs Springs, *Goodding* 1196 (F, M, U, Y).

61. *Penstemon aggregatus* Pennell, sp. nov.

Stems few or several, slightly decumbent at base, erect, 30 to 80 cm. tall, from a much-branched rootstock, puberulent in lines to glabrous above, pale green; leaves pale green, obscurely veined, glabrous, those at the base of the stem much tufted, the blades lanceolate, acute (or the lowermost obtuse), entire, altogether 5 to 17 cm. long, narrowed into a petiole-like base one-half to two-thirds the length of blade, the stem leaves lanceolate or narrowly lanceolate, the upper ones slightly clasping, the largest 7 to 15 cm. long, 1 to 3 cm. wide; thyrsus narrow, not secund, less than one-half the height of the plant, composed of 3 to 8 rather close fascicles, each consisting of 2 axillary, closely erect branches, their pedicels shorter to much longer than the peduncle; sepals 5 to 7 cm. long, lanceolate-attenuate, acuminate, not veined, with white

(to purplish), scarious, nearly entire to proximally erose margins, canescent-puberulent or canescent-ciliate or nearly or quite glabrous; corolla 15 to 18 mm. long, the tube and throat 9 to 11 mm. long (the latter 3 to 4 mm. wide), the throat flattened, 2-grooved anteriorly, the 2 posterior lobes 5 to 6 mm. long, united and arched one-third to one-half their length, with free projecting lobes, the 3 anterior lobes slightly longer, united at the base, the free lobes spreading; corolla externally glabrous (or in bud pubescent with loose nonglandular hairs), within slightly to moderately pubescent with yellowish hairs over the bases of anterior lobes, light blue-violet, more violet on throat, bluer on lobes, paler within and much paler on throat anteriorly; anther sacs widely divaricate, 0.7 mm. long, broadly oval, distinct, opening throughout, glabrous; sterile filament shorter than the fertile ones, slightly wider distally, slightly bearded distally on the dorsal face with yellowish hairs; capsule 6 mm. long, elliptic-ovate, acuminate, glabrous, pale brown; seeds 0.7 to 0.9 mm. long, irregularly quadrangular in outline, not curved, the angles rather blunt, not winged, the surface evidently alveolate-reticulate, glistening, gray, pale toward margin.

Type in the herbarium of the New York Botanical Garden, collected on margin of a draw on mountain side, conglomerate, 1 to 2 miles south of Evanston, Uinta County, Wyoming, altitude about 2,100 to 2,200 meters, in flower, June 26, 1915, by F. W. Pennell (no. 5918).

Apparently most closely allied to *P. rydbergii*, with which it may occasionally intergrade. Usually it may be distinguished readily from this not only by the characters given in the key, but also because it rarely blackens to the same degree.

Sagebrush slopes, among willows, and openings in forest, at altitudes of 1,800 to 2,900 meters; Montane and Submontane zones; flowering from late June to late August. Mountain slopes, through the Wasatch region from southern Lincoln County, Wyoming to Sevier County, Utah; through mountains eastward to Medicine Bow Range of southeastern Wyoming and Middle Park of northern Colorado; on the Uncompahgre Plateau and doubtless on intervening ridges. Extends northwestward into southern Idaho.

WYOMING: Albany: Centennial, *Nelson* 8725, in part (F, U); Fox Park (R). Carbon: Hilton Ranch (near Colorado line), *Osterhout* 1703. Lincoln: La Barge, *Stevenson* 164, in part (U). Uinta: Evanston, *Pennell* 5918 (A, D, F, H, K, M, R, U, Y); Medicine Butte, *Pennell* 5917 (Y).

COLORADO: Grand: Sheephorn Divide, *Shear & Bessey* 4016 (Y); head of Willow Creek (M). Jackson: Rabbit Ears, *Goodding* 1567 (B, M, U, Y); foot of Mount Richtophen (on the Michigan) (U, Y); near Teller (F, Z). Larimer: Cameron Pass, *Osterhout* 56. Montrose: Uncompahgre Divide, *Payson* 559 (M). Routt: Columbine (U, Y); Steamboat Springs, *Goodding* 1606 (A, B, M, U, Y).

UTAH: Salt Lake: Barclay, *Pennell* 5954 (B, P, Y). San Pete: Big Horseshoe Summit (U); Ephraim Canyon, *Tidestrom* 313 (U). Sevier: Fish Lake, Mount Terrill, *Tidestrom* 1823 (U). Summit: Echo Canyon, *Watson* 763 (U). Utah: Soldier Summit, *Pennell* 6131 (D, H, M, R, S, U, Y). Wasatch: Daniels Canyon, *Garrett* 2838 (Y).

62. *Penstemon pseudoprocerus* Rydb.

Penstemon pseudoprocerus Rydb. Mem. N. Y. Bot. Gard. 1: 346. 1900. "Montana: Bridger Mountains, June 12, 1897, *Rydberg & Bessey*, 4919 (type)." Type seen in herbarium of the New York Botanical Garden.

Penstemon pseudohumilis Rydb. Mem. N. Y. Bot. Gard. 1: 347. 1900. "Idaho: Mt. Chauvet, July 29, 1897, *Rydberg & Bessey* 4915 (type)." Type seen in herbarium of the New York Botanical Garden.

Penstemon owenii A. Nels. Bot. Gaz. 34: 32. 1902. "Collected again in 1899, August 16, by the writer, this time also on the Tetons [Wyoming] at an alpine sta-

tion, no. 6516 being the type." Isotype seen in herbarium of New York Botanical Garden.

Penstemon procerus pseudoprocerus A. Nels. in Coulter, New Man. Rocky Mount. 444. 1909.

Varies in the length of tip and laceration of the sepals, the type having a short tip and more lacerate, broad, scarious margin, nearly the opposite extreme being *P. pseudohumilis*.

Open rocky hillsides, at altitudes of 1,900 to 2,700 (3,150) meters; Montane and Submontane zones; flowering from late June to mid-August. Mountain slopes, extending southward in the Bighorn and Teton ranges; southern Montana, northern Wyoming, southern Idaho, and eastern Oregon.

WYOMING: Bighorn: *Worthly* 96 (U). Fremont: Upper Buffalo to head of Du Noir River, *C. C. Curtis* (Y). Lincoln: Sheep Mountain, *Tweedy* 230 (Y); Teton Mountains, *A. & E. Nelson* 6516 (M, Y). Sheridan: Headwaters of Tongue River, *Tweedy* 46 (Y). Yellowstone National Park: Devils Cut (U); Electric Peak (F, U); Hedges Peak, *Pennell* 6021 (Y); Mammoth Hot Springs, *Pennell* 6035 (A, D, H, K, M, P, R, S, Y); Whirlwind Peak, *Cary* 589 (U).

IDAHO: Fremont: Beaver Canyon (Y); Mount Chauvet, *Rydb. & Bessey* 4915 (U, Y).

63. *Penstemon virens* Pennell.

Penstemon virens Pennell; Rydb. Fl. Rocky Mts. 773, 1066. 1917. "Type: Stony hillsides, foothills north of Morrison, Colo., 1915, *Pennell* 5821 (N. Y.)." Type seen in herbarium of the New York Botanical Garden.

Stems several to many, slightly decumbent at base, erect, 15 to 45 cm. tall, from much-branched rootstocks, slender, puberulent in lines, loosely glandular-pubescent above, green; leaves thin, green, dull to rather lustrous, obscurely veined, glabrous, those at the base of the stem much tufted, the blades lanceolate, acute, entire or rarely sparingly and slightly serrate, altogether 6 to 9 cm. long, narrowed into a petiole-like base nearly equaling to slightly exceeding the length of blade, the stem leaves lanceolate, acute, somewhat clasping, entire or serrulate-dentate above, the largest 3 to 7 cm. long, 0.5 to 1.2 cm. wide; thyrsus narrow, not secund, one-third to one-half the height of the plant, composed of 3 to 9 loose fascicles, each consisting of 2 axillary ascending branches, their pedicels shorter than the peduncle; sepals 3 to 4 mm. long, ovate, acuminate, slightly veined, with whitish, scarious, nearly entire margins, loosely glandular-pubescent; corolla 15 to 18 mm. long, the tube and throat 11 to 13 mm. long, the throat 3 to 4.5 mm. wide, inflated, but slightly flattened and 2-grooved anteriorly, the 2 posterior lobes 5 to 6 mm. long, united and arched one-third their length, with free recurved erect lobes, the 3 anterior lobes 5 to 6 mm. long, united proximally, the free lobes spreading; corolla externally glandular-pubescent, within slightly lanose-pubescent with whitish hairs over the bases of the anterior lobes, blue, more violet on throat and when young, paler within and slightly paler without, the throat anteriorly veined within with red-purple lines, these more evident on the anterior lobes; anther sacs widely divaricate, 0.7 to 0.8 mm. long, broadly ovate, distinct, opening throughout, glabrous, dark gray-blue; sterile filament nearly or quite equaling the anterior ones, not or slightly wider distally, densely bearded distally with yellow hairs; capsule 6 to 7 mm. long, ovate, acuminate, glabrous, greenish brown; seeds 1 to 1.2 mm. long, irregularly angular in outline, scarcely curved, the angles sharp, not winged, the surface reticular, dull dark gray or brownish gray, not pale toward margin.

Rocky, wooded slopes, at altitudes of 1,600 to 3,000 meters. Submontane and Montane zones: flowering from late May to early August. Foothills, eastern slope of Medicine Bow Range, southeastern Wyoming, to Culebra Range, southeastern Colorado; common through middle areas; also west of Medicine Bow Mountains in

upper valley of North Platte River, in Carbon County, Wyoming, and Jackson County, Colorado, perhaps crossing from the north into Middle Park.

WYOMING: Albany: Cooper Hill (A, B, M, P, U, Y); Laramie, *Pennell* 5873 (D, F, M, Y); head of Pole Creek (A, M, U, Y); Sand Creek (B, M, U, Y); Sherman (M, U). Carbon: Encampment, *Tweedy* 4305 (U, Y). Laramie: Horse Creek, *Buffum* (F); west of Islay (U).

COLORADO: Boulder: Boulder, *Pennell* 5826 (A, M, U, Y); Eldora Lake (B); Lyons (M); Miramonte (B); Nederland (B); St. Vrain Creek (B); Sugarloaf Mountain (B); Ward (B, M, Y). Clear Creek: Empire (A, M, U, Y); near Georgetown, *Patterson* 117 (F, M, U, Y); Graymont (U); Grays Peak (F, M, Y); Leavenworth Mountain (F). Douglas: *Mrs. S. B. Walker* (F). El Paso: Cheyenne Mountain (Y); Crystal Park (M, U, Y); Eastinvill (U); Lake Moraine (F); Manitou, *Pennell* 5784 (B, Y); North Cheyenne Canyon, *Pennell* 5774 (Y), 6339 (D, H, U, Y); Palmer Lake, *Pennell* 5807 (H, U, Y); Pikes Peak (above Halfway House), *Pennell* 6319 (R, Y); South Cheyenne Canyon, *Pennell* 5792 (F, M, R, Y). Fremont: Canon City, *Brandegge* (M). Gilpin: Antelope (B); Eldora to Baltimore (Y); Tolland, *Pennell* 6355 (F, P, Y). Grand (?): "Middle Park," *Henry* (M; with specimens of *P. watsoni*). Huerfano: Turkey Creek and tributaries (Y); Wahatoya Canyon, *Rydberg & Vreeland* 5638 (Y). Jackson: Camp Creek, *Goodding* 1458 (A, B, M, P, U, Y). Jefferson: Golden, *Pennell* 5816 (M, Y), 6387 (Y); Morrison, *Pennell* 5821 (D, H, R, U, Y); Platte Canyon (U). Larimer: Dale Creek (Y); Dixon Canyon (F, U); Estes Park (M, R, U); Horsetooth Mountain, *Pennell* 5853 (F, K, P, R, Y), 5854 (S, Y), 5861 (D, Y); Howes Gulch (Y); North Box Elder (B); Owl Canyon, *Pennell* 5871 (Y); Pinewood; Rist Canyon (M); Ten-mile Creek (B). Las Animas: Brantly Canyon, *Osterhout* (Y). Park: South Park, *Wolf* 297 (U, Y). Pueblo: Near Beulah, *Robbins* 4489 (B).

64. *Penstemon brevifolius* (A. Gray) A. Nels.

Penstemon humilis brevifolius A. Gray, Syn. Fl. 2¹: 267. 1878. "*P. humilis*, var. ? Watson l. c. [in King, Geol. Expl. 40th Par. 5: 220. 1871]. * * * Utah, in the Wahsatch Mountains, at 9,000 or 10,000 feet, *Watson, Eaton*." According to Watson (loc. cit.), "In the Wahsatch Mountains; 9-10,000 feet altitude; July, August (781)." Iso-type, *Watson* 781, collected in Cottonwood Canyon, Utah, altitude 2,700 meters, July, 1869, seen in herbarium of Columbia University at the New York Botanical Garden.

Penstemon brevifolius A. Nels. in Coulter, New Man. Rocky Mount. 445. 1909.

Rocky cliffs and summits, at altitudes of 2,400 to 3,200 meters; Montane and Sub-alpine zones; flowering from mid-June to late July. Northern Wasatch Mountains, Utah, and East Humboldt Mountains, Nevada.

UTAH: Salt Lake: Alta (F, Y); near Clayton Peak (M); Emigration Canyon, *Pennell* 5986 (H, M, R, U, Y); Lake Blanche, *Pennell* 5975 (D, H, M, P, R, U, Y); near Silver Lake, *Pennell* 6086 (F, K, S, Y), 6092 (A, Y). Toole: Ophir City, *E. S. Blackwell* (P). Utah: American Fork Canyon, *Jones* 1405 (F, U).

65. *Penstemon obtusifolius* Pennell, sp. nov.

Stems several, more or less decumbent at base, erect, 15 to 20 cm. tall, from much-branched rootstocks, slender, below puberulent with reflexed hairs, above glandular-pubescent, light green; leaves thin, pale green, dull, obscurely veined, glabrous, those at the base of the stem much tufted, the blades broadly oval, obtuse or nearly so, entire, 2 to 3 cm. long, 1.5 to 2.2 cm. wide, abruptly narrowed to a slightly margined petiole about equaling the length of blade, the stem leaves oblong-lanceolate; acutish, clasping, entire or serrulate, the largest 2.3 cm. long, 0.5 to 0.7 cm. wide; thyrsus narrow, not secund, one-third to one-half the height of the plant composed of about 4 loose fascicles, each consisting of 2 axillary ascending branches, their pedi-

cels shorter than the peduncle; sepals 5 mm. long, lanceolate, acuminate, finely glandular-pubescent; corolla 10 to 12 mm. long, the tube and throat 7.5 to 9 mm. long, the throat 2 to 2.5 mm. wide, somewhat inflated, somewhat flattened and 2-grooved anteriorly, the 2 posterior lobes 2.5 to 3 mm. long, all the lobes united near base, the free lobes spreading; corolla externally glandular-puberulent, within slightly lanose-pubescent over the bases of the anterior lobes, blue (not seen fresh); anther sacs widely divaricate, 0.5 mm. long, broadly oval, distinct, opening throughout, glabrous, grayish; sterile filament nearly or quite equaling the anterior ones, scarcely wider distally, bearded distally with short yellow hairs; capsule not seen.

Type in the U. S. National Herbarium, no. 260682, collected at Springdale, Washington County, Utah, altitude 1,200 meters, in flower, May 16, 1894, by Marcus E. Jones (no. 5249am; distributed as *P. humilis brevifolius* S. Wats.).

Upper Sonoran Zone.

66. *Penstemon humilis* Nutt.

Penstemon humilis Nutt.; A. Gray, Proc. Amer. Acad. 6: 69. 1862. "*P. humilis* Nutt., in herb. Acad. Philad. * * * Rocky Mountains, Nuttall (a very depauperate doubtless alpine specimen in herb. Acad. Philad.)". Aggregate, but name to be applied to Nuttall's plant. Type, doubtless collected by Nuttall on hills in southwestern Wyoming or southeastern Idaho, seen in herbarium of Academy of Natural Sciences of Philadelphia.

Penstemon collinus A. Nels. Bull. Torrey Club 25: 279. 1898. "Type specimen in Herb. University of Wyoming [A. Nelson] no. 2960, Evanston [Wyoming], May 28, 1897." Isotype seen in herbarium of the New York Botanical Garden.

Gravelly sagebrush slopes, at altitudes of 1,500 to 2,400 meters; Submontane Zone (descending rarely into Upper Sonoran Zone); flowering from mid-May to early July. Foothills, from Jacksons Hole southward through the Teton and northern Wasatch regions to Juab County, Utah, southern Idaho, and northeastern Nevada.

WYOMING: Lincoln: Cokeville, *Nelson* 4549 (F); Jacksons Hole, *Hayden* (M); La Barge (U). Uinta: Evanston, *Nelson* 2960 (M, Y), 7197 (B, M, U, Y), *Pennell* 5894 (B, D, Y), 5901 (K, P, Y), 5922 (A, S, Y); base of Medicine Butte, *Pennell* 5914 (Y); Piedmont (R).

IDAHO: Bannock: Oxford; Pocatello, *Pennell* 6063 (A, F, H, M, R, U, Y); Soda Springs (M, Y). Bear Lake: Montpelier, *Macbride* 15 (M, U, Y), 202 (M, U).

UTAH: Cache: Logan, *C. P. Smith* 1629 (E, R), 2202 (Y). Juab: Eureka, *Jones* (M, U, Y). Morgan: Devils Slide, *Pennell* 5941 (F, U, Y), 5951 (Y). San Pete: Ephraim Canyon, *Tidestrom* 1171 (U); Indianola (U); San Pitch Mountains (U). Sevier: Fishlake Forest, *Eggleston* 11127 (U). Summit: Echo, *Pennell* 5930 (Y), 5936 (H, M, Y). Uinta: Brush Creek Canyon, *Goodding* 1289 (F, U, Y). Utah: Provo, *Pennell* 6112 (A, D, F, H, K, M, P, R, U, Y).

67. *Penstemon radicosus* A. Nels.

Penstemon radicosus A. Nels. Bull. Torrey Club 25: 280. 1898. "Type specimens in Herb. University of Wyoming, [A. Nelson] no. 2962, Evanston [Wyoming], May 28, 1897." Isotype seen in herbarium of the New York Botanical Garden.

Dry, gravelly slopes, sides of mesas, sagebrush draws, at altitudes of 1,600 to 2,300 meters; Submontane, descending into Upper Sonoran Zone; flowering from late May to early July. Mesas and foothills from Medicine Bow River westward across southern Wyoming to the valley of Snake River in southern Idaho, southward entering North Park, Colorado, Summit County, Utah, and northern Nevada, northward through valley of Henry River and entering southwestern Montana and Yellowstone National Park.

WYOMING: Albany: Ridge (R); Rock River, *Goodding* 27 (F, M, U, Y). Carbon: Boggs (Y); Fort Steele (U, Y); Freezeout Hills (F); Medicine Bow (R); Rawlins, *Pennell* 5879 (F, H, M, R, Y). Fremont: Pacific Springs, *Parry* 208 (F). Lincoln: Cokeville, *Nelson* 4659 (R). Sweetwater: Bush Ranch (B, M, U, Y); Leucite Hills (U, Y); Point of Rocks, *Pennell* 5887 (Y); Tipton; Wamsutter, *Pennell* 5883 (A, B, D, F, H, K, M, P, R, S, U, Y), 5885 (Y; albino). Uinta: Evanston, *Nelson* 2962 (M, Y), *Pennell* 5896 (D, P, Y), 5903 (A, K, M, U, Y), 5920 (F, H, Y); base of Medicine Butte, *Pennell* 5915 (R, Y). Yellowstone National Park: Mammoth Hot Springs, *Pennell* 6033 (B, P, S, Y); on south fork of Shoshone (Y).

IDAHO: Bannock: Oxford (Y); Pocatello, *Pennell* 6064 (A, B, D, F, H, K, M, P, R, S, U, Y). Bingham: Big Butte Station, *Palmer* 203 (U). Fremont: Beaver Canyon, *Rydberg* (Y).

COLORADO: Jackson: Pinkham Creek, *Goodding* 1471 (A, B, M, U, Y).

UTAH: Summit: Echo, *Pennell* 5939 (Y).

68. *Penstemon oliganthus* Woot. & Standl.

Penstemon oliganthus Woot. & Standl. Contr. U. S. Nat. Herb. 16: 172. (Feb. 12) 1913. "Type in the U. S. National Herbarium, no. 259061, collected in the mountains west of Grants Station [New Mexico], August 1, 1892, by E. O. Wootton." Type seen in the U. S. National Herbarium. Unfortunately this consists of late, small, shriveled-flowered specimens, with only few and small basal leaves still attached.

Penstemon griffinii A. Nels. Bot. Gaz. 56: 70. (July 16) 1913. "Collected by Alfred A. Griffin in the Rio Grande Valley [Colorado], on moist east slopes, at 8,200 feet, July 28, 1912, no. 145." Type seen in the Rocky Mountain Herbarium.

Grassy glens, open pine woods, and rocky hillsides, at altitudes of 2,100 to 2,600 meters; Submontane and Montane zones; flowering from late July to mid-August. Mountain slopes from Park County, Colorado, southward to north-central New Mexico.

COLORADO: Chaffee: Base of Mount Princeton, *Sheldon* 243 (U), 554 (U, Y); Salida, *Pennell* 6310 (D, R, U, Y). Fremont(?): Wet mountain valley, *Redfield* 5981 (M), 6021 (M). Park: Divide west of salt works, South Park, *Porter* (F, Y). Mineral: Wagonwheel Gap, *Griffin* 145 (R).

69. *Penstemon gracilis* Nutt.

Penstemon gracilis Nutt. Gen Pl. 2: 52. 1818. "Hab. from the Arikarees [South Dakota] to Fort Mandan [North Dakota], in depressed soils." Type seen in herbarium of Academy of Natural Sciences of Philadelphia.

Chelone gracilis Spreng. Syst. Veg. 2: 813. 1825.

Penstemon digitalis gracilis Trauttv. Bull. Acad. St. Pétersb. 5: 345. 1839.

Penstemon pubescens gracilis A. Gray, Proc. Amer. Acad. 6: 69. 1862-3.

Moist grassy places, at altitudes of 1,000 to 2,100 meters; Submontane and Upper Sonoran zones; flowering from early June to mid-July. High plains, entering north-central Wyoming and eastern Colorado to the base of the foothills. Manitoba to Saskatchewan, south probably to Kansas and northeastern New Mexico.

SOUTH DAKOTA: Fall River: Hot Springs, *Rydberg* 921, in part (Y). Lawrence: Deadwood, *Carr* 35 (U, Y); Este (Y); Lead City (Y). Meade: Bear Butte ("Bear's Peak") (M); Fort Meade, *Forwood* 286 (U). Pennington: Rapid City, *Visher* (F). Stanley: Cedar Pass (U); Fort Pierre, *Geyer* 127 (U). Washabaugh: Cottonwood Canyon, *Visher* 200 (Y).

NEBRASKA: Deuel: *Rydberg* 279 (Y). Lincoln: Hershey, *Mell* 75 (U). Thomas: Halsey, *Krautter* (P).

WYOMING: Johnson: Eastern slope of Bighorn Mountains, *Tweedy* 3413 (Y), 3414 (Y). Sheridan: Little Goose Creek, *Nelson* 2375 (R).

COLORADO: Boulder: Boulder, *Ramaley* 9593 (B). Douglas: Larkspur, *Johnston & Hedgcock* 436 (Y). El Paso: North of Cheyenne Canyon, *Bessey* (Y); Colorado Springs; Monument Park (A, U); Palmer Lake (U); Ute Pass (M). Huerfano: Wahatoya Creek, *Rydberg & Vreeland* 5640 (P).

70. *Penstemon harbourii* A. Gray.

Penstemon harbourii A. Gray, Proc. Amer. Acad. 6: 71. 1862. "Rocky mountains of Colorado Territory, in the high alpine region, no. 396 of Hall and Harbour's distribution; found only by Mr. J. P. Harbour." Isotypic seen in herbarium of Columbia University at the New York Botanical Garden.

Penstemon bakeri Greene, Pittonia 4: 318. 1901. "At 11,500 feet in the mountains about Pagosa Peak, southern Colorado, 6 Aug., 1899, C. F. Baker."

Rocky slopes above timber line, especially on rock slides, at altitudes of 3,300 to 4,100 meters; Alpine Zone; flowering from early July to early August. High mountains of Colorado, from Medicine Bow Mountains to Sangre de Cristo Range and La Plata Mountains.

COLORADO: Chaffee: Mount Princeton, *Sheldon* 241 (U), 553 (U, Y). Clear Creek: Above Berthoud Pass (M); near Georgetown (M); Grays Peak (M, U); Mount Flora (M); Mount McClellan, *Patterson* 118 (F, M, U, Y). Fremont: Sangre de Cristo Range, *Brandegee* 804 (M). Gunnison: Sheep Mountain, *Purpus* 607 (F). Larimer: Near Lulu Pass, *Osterhout* 603; Mount Richtophin (Y). La Plata: La Plata Mountains (U); Virginia Gulch, south slope of Needle Mountains, *Cross* 27 (U). Ouray: Along Horsethief Trail east of Ouray, *Pennell* 6236 (A, B, D, F, H, K, M, P, R, S, U, Y). Mount Abram, *Pennell* 6187 (U, Y). San Miguel: Yellow Mountain, Ophir, *J. V. Brewster* (D). Summit: Mount Baldy (M); Mount Breckenridge, *Hall & Harbour* 396 (A, E, F, M).

71. *Penstemon retrorsus* Payson, sp. nov.

Stems loosely tufted, much branched below, spreading and soon ascending and erect, 10 to 20 cm. tall, from a very short caudex, pubescent with reflexed-spreading cinereous hairs; leaves light green, not veined, cinereous-pubescent, entire, the blades of lower leaves oblanceolate, attenuate to an ill-defined petiole, the stem leaves sessile, lanceolate, the largest leaves mostly 2.5 to 3.5 cm. long, 0.3 to 0.4 cm. wide; thyrsus narrow, composed of 6 to 12 fascicles, each consisting of 2 axillary branches, each of these bearing several flowers, their pedicels usually shorter than the common peduncle; sepals 3 to 4 mm. long, ovate-lanceolate, acutish to acute, not ribbed, not scarious-margined, densely and finely cinereous-pubescent; corolla 16 to 20 mm. long, the tube and throat 13 to 15 mm. long, the throat slightly inflated, flattened and 2-ridged within ventrally, the 2 posterior lobes 2.5 to 3 mm. long, united and arched about two-thirds their length, projecting, the 3 anterior lobes 3 to 5 mm. long, united at base, spreading; corolla externally glandular-puberulent, within pubescent over the bases of the anterior lobes, glabrous elsewhere, blue (not seen fresh); anther sacs widely divaricate, 0.6 mm. long, ovate, glabrous, distinct, with relatively long line of contact, opening throughout, the suture minutely ciliolate; sterile filament included, flat, not enlarged distally, bearded most of its length (densely distally) with golden-yellow hairs on the posterior face; capsule not seen.

Type in the herbarium of the New York Botanical Garden, collected on a dry adobe hill near Montrose, Colorado, altitude 1,740 meters, in flower, June 15, 1915 by Edwin Payson (no. 673).

Adobe hills, at an altitude of 1,740 meters; Upper Sonoran Zone; flowering in mid-June. Valley of Uncompahgre River in western Colorado.

COLORADO: Montrose: Montrose, *R. Dawson* (D); *Payson* 673 (Y).

72. *Penstemon thompsoniae* (A. Gray) Rydb.

Penstemon pumilus thompsoniae A. Gray, Syn. Fl. 2¹: 269. 1878. "S. Utah, Mrs. Thompson." Type, from Kanab, Utah, collected in 1872, seen in Gray Herbarium.

Penstemon thompsoniae Rydb. Bull. Torrey Club 36: 690. 1909.

Southern Utah and northern Arizona.

UTAH: Kane: Kanab, Mrs. Thompson (H). Without data, Bishop 250 in 1872 (U).

73. *Penstemon crandallii* A. Nels.

Penstemon crandallii A. Nels. Bull. Torrey Club 26: 354. 1899. "I am indebted to Prof. C. S. Crandall for specimens of this plant, collected by him near Como, Park County, Colorado, July 23, 1897." Type seen in Rocky Mountain Herbarium.

"Gravelly places," at altitudes of 2,800 to 3,000 meters; Montane Zone; flowering from early July to early August. Park and Chaffee counties, central Colorado.

COLORADO: Chaffee: South Cottonwood Gulch, Sheldon 547 (U, Y, Z). Park: Como, Cowen (F, M, U, Y), Crandall 4197 (Y), Shear 4582 (Y), 4583 (Y).

74. *Penstemon suffrutescens* Rydb.

?*Penstemon caespitosus suffruticosus* A. Gray, Syn. Fl. 2¹: 270. 1878. "Utah, near Beaver, Palmer." Type, in fruiting stage, seen in Gray Herbarium. Pedicels and calyx more glandular than in *P. suffrutescens*. Probably distinct.

Penstemon suffrutescens Rydb. Bull. Torrey Club 38: 503. (Sept. 30) 1901. "Colorado: Ridgway, 1895, F. Tweedy 170." Type, collected June 20, seen in herbarium of the New York Botanical Garden.

Penstemon procumbens Greene, Pl. Baker. 3: 23. (Nov. 18) 1901. "Forming large mats on open slopes at Keblar Pass [Colorado], 7 Aug., 1901, [C. F. Baker] n. 733." Isotype seen in U. S. National Herbarium. With smaller, broader leaves, and more procumbent habit than specimens seen of *P. suffrutescens*; needs further field study.

"Woods," at altitudes of 2,200 to 3,000 meters; Submontane and Montane zones; flowering from late June to early August. Gunnison and Delta to Ouray counties, west-central Colorado, and probably to central Utah.

COLORADO: Gunnison: Keblar Pass, Baker 733 (M, U, Y); Elk Mountains, Brandegee (M). Ouray: Ridgway, Tweedy 170 (U, Y).

UTAH: Piute: Mountains north of Bullion Creek, near Marysvale, Rydberg & Carlton 7106 (Y).

75. *Penstemon xylus* A. Nels.

Penstemon xylus A. Nels. Bot. Gaz. 34: 31. 1902. "The specimens before me were collected by Mr. H. N. Wheeler at Sapinero, Colorado, 1898, no. 446." Type seen in Rocky Mountain Herbarium. Apparently but one specimen collected by me while at Sapinero, and this among dense growths of *P. teucrioides*. Perhaps the "species," at least at times, represents an intermediate (hybrid?) between *P. teucrioides* and *P. suffrutescens*. Needs further field study.

Sagebrush hills, at altitudes of 1,700 to 2,800 meters; Upper Sonoran and Submontane zones; flowering from late May to mid-July. Scattered through western Colorado and southeastern Utah.

COLORADO: Delta: Paonia, Osterhout 4523 (Y); Mesa Grande (F). Eagle: Wolcott, Osterhout 2112. Fremont: Brandegee (M). Gunnison: Sapinero, Pennell 6269 (Y), H. N. Wheeler 446 (B). Hinsdale: Lake City, Purpus 721 (F). Mineral: Wagonwheel Gap, B. H. Smith (A). Montrose: Cimarron, Baker 333 (F, M, R, U, Y); Naturita, Payson 361 (R). Ouray: Ridgway, Tweedy 171 (U).

UTAH: La Sal Mountains, Purpus 5693 (M).

76. *Penstemon caespitosus* Nutt.

Penstemon caespitosus Nutt.; A. Gray, Proc. Amer. Acad. 6: 66. 1862. "Rocky Mountains, Nuttall (a diminutive specimen in herb. Acad. Philad.)." Type, labeled "R. Mts., N. Calif.," seen in herbarium of the Academy of Natural Sciences of Philadelphia.

Dry, gravelly, sagebrush slopes, at altitudes of 1,800 to 2,100 meters; Submontane Zone; flowering from late May to early July. Foothills and lower mountain slopes, Wasatch Mountains, southwestern Wyoming, Uinta Mountains of northern Utah, and in northern Colorado.

WYOMING: Carbon: Saratoga, *Buffum* 713 (F, R). Uinta: Carter (R); Fort Bridger; Evanston, *Pennell* 5895 (F, H, M, U, Y); Leroy (R).

COLORADO: Eagle: McCoys, *Osterhout* 2762 (Y). Grand: Mount Bross, *Patterson* (F, M, Y); Sulphur Springs (Y); Willow Creek (M). Moffat: North of Craig, *Osterhout* 2623 (Y). Routt: Egeria Park, *Eastwood* (Y).

UTAH: Uinta: Dyer Mine, *Goodding* 1237 (F, R, U, Y).

76a. *Penstemon caespitosus perbrevis* Pennell, subsp. nov.

Leaves shorter, 0.5 to 1 (sometimes 1.2) cm. long, much more abruptly widening upward, spatulate-obovate, nearly all with petiole-like bases; sepals less attenuate, acuminate; plants closely prostrate, the ultimate ascending branches very short. Otherwise as in the species.

Type in the herbarium of the New York Botanical Garden, collected on dry sagebrush summit of mesa, at Castle Gate, Carbon County, Utah, altitude about 2,200 to 2,400 meters, in shriveled blossom, July 18, 1915, by F. W. Pennell (no. 6138).

Sagebrush-covered mesas, at altitudes of (1,600) 2,100 to 2,400 meters; Upper Sonoran and Submontane zones; flowering from early June to early July. Wasatch region of central Utah.

UTAH: Carbon: Castle Gate, *Pennell* 6138 (R, U, Y). Garfield: Tropic, *Jones* 5312ai (U). Utah: Soldier Summit, *Jones* 5599 (M, U, Y); near Thistle (U, Y).

77. *Penstemon teucrioides* Greene.

Penstemon teucrioides Greene, Pl. Baker. 3: 23. 1910. "Collected at Sapinero [Colorado], 19 June [1901]; said to be common there on dry ground, [C. F. Baker] n. 186." Isotype seen in U. S. National Herbarium.

Dry, stony, sagebrush slopes, at altitudes of 2,100 to 2,800 meters. Submontane Zone; flowering from late June to early August. Common to abundant in Gunnison Valley, west-central Colorado.

COLORADO: Gunnison: Gunnison, *Pennell* 6283 (Y); Sapinero, *Baker* 186 (M, R, U, Y), *Pennell* 6263 (B, F, Y), 6268 (D, H, K, M, P, R, U, Y), 6276 (A, S, Y), *H. N. Wheeler* 399 (B, R). Hinsdale: Lake City, *Purpus* 721, in part (F). Saguache: Sargents, *Pennell* 6302 (D, F, H, M, R, U, Y).

78. *Penstemon glabrescens* Pennell, sp. nov.

Stems tufted, much branched, prostrate and ascending, spreading, 7 to 15 cm. tall, from a woody caudex, with long woody prostrate stems, puberulent with reflexed cinereous hairs; leaves somewhat thickened, light green above and beneath, not veined, sparsely puberulent above proximally or usually glabrate, entire, all cauline, the blades sessile, linear, acute, the largest mostly 1 to 1.5 cm. long, 0.7 to 1 mm. wide; thyrsus narrow (flowers seemingly axillary), composed of 4 to 8 fascicles, each consisting of 2 axillary branches, each bearing 1 or 2 flowers; sepals 5 to 8 mm. long, lance-ovate to ovate, acuminate to caudate, not ribbed, proximally with margins more or less scarious and erose, slightly glandular-puberulent; corolla 16 to 18 mm.

long, the tube and throat 12 to 13 mm. long, the throat slightly inflated, flattened and 2-ridged within ventrally, the 2 posterior lobes 4 to 5 mm. long, united and arched two-thirds their length, projecting, the 3 anterior lobes 4 to 5 mm. long, united at base, spreading; corolla externally glandular-puberulent, within slightly pubescent over the bases of the anterior lobes, glabrous elsewhere, sky-blue, within violet at base of lobes, pale within the throat, on anterior side with violet lines, one of these extending medianly into each lobe (not seen fresh); anther sacs widely divaricate, 1 mm. long, oblong, glabrous, distinct, with short line of contact, opening throughout, the suture minutely ciliolate; sterile filament included, flat, scarcely enlarged distally, bearded nearly throughout (densely so distally) with golden-yellow hairs on the posterior face; capsule 7 mm. long, ovate, acuminate, glabrous; seeds 1.5 to 1.7 mm. long, irregularly quadrangular, curved, the angles sharp, not winged, the surface very minutely alveolate-reticulate, blackish, slightly glistening.

Type in the herbarium of the New York Botanical Garden, collected on open mesas and gravelly hillsides at Pagosa Springs, Colorado, in flower, July 2, 1917, by E. Bethel.

Open sagebrush (?) mesas and slopes, frequently gravelly, at altitudes of 2,000 to 2,200 meters; Upper Sonoran Zone; flowering from June to late July. Valley of San Juan River in southwestern Colorado.

COLORADO: Archuleta: Pagosa Springs, *Bethel* (D, Y). La Plata: Bayfield, *Bethel* (D, Y). Montezuma: Lone Mesa (U); Mancos, *Baker, Earle & Tracy* 27 (F, M, U, Y).

79. *Penstemon abietinus* Pennell, sp. nov.

Stems tufted, much branched, prostrate and ascending, spreading, less than 5 cm. tall, from a thick woody caudex, although often with long woody prostrate stems, densely grayish-puberulent with reflexed hairs; leaves thickened, dull pale green above and beneath, not veined, sparsely puberulent above or glabrate, entire, all cauline, the blades sessile, linear, acute, the largest mostly 1 to 1.2 cm. long, 0.8 to 1.2 mm. wide; thyrsus narrow (flowers seeming axillary), composed of few (1 to 4) fascicles, each consisting of 2 axillary shortened branches, each of these bearing usually but a single flower; sepals 4 to 5 mm. long, lanceolate-attenuate, acuminate, not ribbed, proximally with slightly erose, expanded, scarious margins, slightly glandular-puberulent; corolla 12 to 15 mm. long, the tube and throat 8 to 10 mm. long, the throat scarcely inflated, flattened and 2-ridged within ventrally, the 2 posterior lobes 4 to 5 mm. long, united and arched one-third to two-fifths their length, projecting, the 3 anterior lobes 4 to 5 mm. long, united at base, spreading; corolla externally glandular-puberulent, within slightly pubescent over bases of the anterior lobes, glabrous elsewhere, blue (not seen fresh); anther sacs widely divaricate, 1 mm. long, oblong-ovate, glabrous, distinct, with short line of contact, opening throughout, the suture nearly glabrous; sterile filament included, flat, scarcely enlarged distally, densely bearded nearly throughout with golden-yellow hairs on the posterior face; capsule not seen.

Type in the U. S. National Herbarium, no. 237297, collected at Ireland Ranch, head of Salina Canyon, Utah, altitude 2,400 meters, in flower, June 15, 1894, by Marcus E. Jones (no. 5440; distributed as *P. caespitosus* Nutt.). Isotype in herbarium of New York Botanical Garden.

Probably Submontane Zone.

UTAH: Sevier: Ireland Ranch, head of Salina Canyon, *Jones* 5440 (F, M, R, U, Y); Salina Experiment Station, Fishlake Forest, *Eggleston* 11138 (U).

80. *Penstemon whippleanus* A. Gray.

Penstemon glaucus stenosepalus A. Gray, Proc. Amer. Acad. 6: 70. 1862. "Rocky Mountains, -about Pikes Peak, Clear Creek, &c., Dr. James in herb. Torr., Dr

Parry, 261, 262, and coll. 1862, distributed by Hall and Harbour, 399." Isotype, Parry 261, "from the headwaters of Clear Creek and the alpine ridges lying east of Middle Park, Colorado," collected in 1861, seen in herbarium of the New York Botanical Garden.

Penstemon whippleanus A. Gray, Proc. Amer. Acad. 6: 73. 1862. "Arroyas in the Sandia Mountains, New Mexico, east of the Rio Grande, Dr. J. M. Bigelow, in Whipple's Expedition, Oct., 1853." Sterile filament in species slightly barbed at apex to nearly or (in type material) quite glabrous.

Penstemon stenosepalus Howell, Fl. Northw. Amer. 1: 514. 1901.

Occurs in several apparently distinct color forms, separable only by field observation. Through the Colorado and Utah mountains red-violet is prevalent, but high on some mountains—e. g., Pikes Peak—a very pale greenish brown form occurs. In the Wasatch Mountains I have seen the color lavender, but Watson says that this is not the prevalent form. In the Teton Mountains, Wyoming (*Nelson* 100) a blue form exists.

Wooded or subalpine grassy mountain slopes, at altitudes of (2,200) 2,500 to 3,600 (3,900) meters; Subalpine and Montane zones, ascending to Alpine Zone; flowering from early July to late August. High mountains, from Teton and Wind River mountains, Wyoming, southward through Bear River Range, Idaho, through nearly all chains of Colorado and Utah to northern New Mexico and northern Arizona.

WYOMING: Albany, Carbon, Fremont, Lincoln, and Park counties.

IDAHO: Oneida County.

COLORADO: Boulder, Chaffee, Clear Creek, Delta, El Paso (6326), Gilpin (6361, 6362), Grand, Gunnison, Hinsdale, Huerfano, Jackson, Lake, La Plata, Larimer, Mineral, Montrose, Ouray (6192, 6202, 6206, 6210, 6244), Park, Routt, Saguache, San Juan, San Miguel, and Summit counties.

UTAH: Grand, Piute, Salt Lake (6074, 6104), San Juan, San Pete, Sevier, Summit, Utah, and Wayne counties.

81. *Penstemon montanus* Greene.

Penstemon montanus Greene, Pittonia 2: 240. 1892. "Mr. Tweedy's n. 866, from alpine heights on the mountains of Yellowstone Park, Wyoming." Isotype, collected on Mount Norris, in flower, July, 1885, seen in U. S. National Herbarium.

Rocky slopes, at altitudes of 2,400 to 3,000 (3,200) meters; Subalpine and perhaps neighboring zones; flowering from late July to late August. High mountains, from Yellowstone and Wasatch mountains to San Pete County, Utah. In southwestern Montana and central Idaho.

WYOMING: Lincoln: Buffalo Fork, *Tweedy* 232 (Y), 233 (Y); headwaters of Cliff Creek (Y); Hoback River Canyon (U). Park: "Stinking-water," *Parry* 204 (F). Yellowstone National Park: Electric Peak, *Rydberg & Bessey* 4909 (F, U, Y); Mount Norris (U).

IDAHO: Fremont: Mount Chauvet, *Rydberg & Bessey* 4908 (F, R, U, Y). Franklin: Western boundary of Franklin Basin, *C. P. Smith* 2296 (R, Y).

UTAH: Salt Lake: Little Cottonwood Canyon, *Jones* (M, U). San Pete: Black Mountain, Manti, *Jones* (M). Utah: Silver Lake, American Fork Canyon, *Jones* (M, U).

82. *Penstemon fruticosus* (Pursh) Greene.

Gerardia fruticosa Pursh, Fl. Amer. Sept. 423. pl. 18. 1814. "In great abundance in the pine forests of the Rocky Mountains. *M. Lewis* * * * v. s. in *Herb. Lewis*." Specimen (from Lambert Herbarium) in herbarium of Academy of Natural Sciences of Philadelphia labeled "*Gerardia suffruticosa* n. sp. new species. A small shrub from the Rocky Mountain, abundant in piny lands, Jun. 15, 1806." According to E. Coues (Proc. Acad. Phila. 1898: 293. 1899), Lewis and Clark were, on June 15,

1806, along Collins Creek, a branch of the Kooskooskee; now Nahwah River, or Lolo Fork of Clearwater River, in Clearwater County, Idaho. Isotype seen in herbarium of Academy of Natural Sciences of Philadelphia. The type shows leaves relatively strongly serrate, a variable character, but it has broadly lanceolate sepals, thus differing from *P. scouleri* Hook.

Dasanthera fruticosa Raf. Amer. Month. Mag. 267. 1818. Type of genus *Dasanthera* Raf.

Penstemon crassifolius Lindl. Bot. Reg. 24: pl. 16. 1838. "A native of the North West coast of North America, whence seeds were sent by the late Mr. Douglas to the Horticultural Society of London in whose garden it was figured in June last." This represents the state of the species with leaves most nearly entire.

Penstemon fruticosus Greene, Pittonia 2: 239. 1892.

Penstemon menziesii crassifolius Schelle in Beissner, Schelle & Zaber, Handb. Laubh. Benen. 432. 1903.

Penstemon fruticosus crassifolius Krautter, Contr. Bot. Lab. Univ. Pa. 3: 100. 1908.

Rocky woodland, mountain slopes, at altitudes of 2,000 to 2,300 meters; Montane Zone; flowering from early July to early August. Bighorn Mountains and Yellowstone National Park, Wyoming, westward. Western Montana and northern Wyoming to eastern Washington and eastern Oregon.

WYOMING: Park: Grinnell Creek, *Cary* 569 (U). Yellowstone National Park: Crevasse Mountain; Golden Gate, *Pennell* 6030 (F, H, Y); along Madison River, *Pennell* 5990 (Y); Mammoth Hot Springs (M, U, Y); Slough Creek (U); Spring Creek (R); Upper Geyser Basin, *Pennell* 6001 (R, U, Y).

IDAHO: Fremont: Henrys Lake and Mount Chauvet, *Rydborg & Bessey* 4907 (F, U, Y).

83. *Penstemon bridgesii* A. Gray.

Penstemon bridgesii A. Gray, Proc. Amer. Acad. 7: 379. 1868. "No. 218 in Californian collection of the late Thomas Bridges." Isotype seen in herbarium of the New York Botanical Garden.

Rocky cliffs, canyons, mountain slopes, at altitudes of 1,800 to 2,600 meters; Submontane and Montane zones; flowering from mid-June to late August. Low mountains, Sierra el Late, Montezuma County, Colorado and Abajo Mountains, San Juan County, Utah, westward across southern Utah. Extending to northern Arizona and central and southern California.

COLORADO: Montezuma: Sierra el Late, *Brandegge* 1293 (M).

UTAH: Piute: Marysvale, *Rydborg & Carlton* 7123 (U, Y). San Juan: Sierra Abajo (U, Y); Western Bears Ear, Elk Mountains, *Rydborg & Garrett* 9373 (U, Y), 9374 (Y). Sevier: Clear Creek Canyon, *Garrett* 2517 (M, Y); canyon south of Glenwood (U). Wayne: Jukes Butte, Henry Mountains, *Jones* 5664 (M, U, Y).

84. *Penstemon platyphyllus* Rydb.

Penstemon heterophyllus latifolius S. Wats. in King, Geol. Expl. 40th Par. 5: 222. 1871. "Wahsatch Mountains; 5-8,000 feet altitude. [*S. Watson*] (787)." Isotype, collected in Cottonwood Canyon, Utah, July, 1869, seen in herbarium of Columbia University at the New York Botanical Garden.

Penstemon latifolius Krautter, Contr. Bot. Lab. Univ. Pa. 3: 194. 1908. Not *P. latifolius* Hoffmg. 1824.

Penstemon platyphyllus Rydb. Bull. Torrey Club 36: 690. 1909. "Utah: Cottonwood Cañon, July, 1869, *S. Watson* 787." Type is isotype of *P. heterophyllus latifolius* S. Wats.

Rocky mountain slopes and canyons, at altitudes of 1,300 to 2,400 meters; Subalpine Zone, descending on canyon sides into Upper Sonoran Zone; flowering from

mid-May to late July. Western slope of Wasatch Mountains from Weber to Utah counties, Utah.

UTAH: Davis: Farmington Canyon, *Pammel & Blackwood* 3659 (M). Salt Lake: Big Cottonwood Canyon, *Pennell* 6067 (H, M, R, U, Y), 6068 (U, Y); South Fork of Big Cottonwood Creek, *Pennell* 5980 (A, B, F, M, R, Y); City Creek Canyon (U, Y); Emigration Canyon, *Pennell* 5985a (F, Y); Mill Creek Canyon (U, Y); Parleys Canyon. *Pennell* 5957 (D, H, K, M, P, R, S, U, Y); Red Butte (F, M). Utah: American Fork Canyon, *Jones* 1888 (F, M, U). Weber Mountains near Ogden, *Coulter* (Y).

85. *Penstemon leonardi* Rydb.

Penstemon leonardi Rydb. Bull. Torrey Club 40: 483. 1913. "Utah: Diehl's Grove, Wahsatch Mountains, Aug. 1, 1884, *Leonard* (type, in herb. N. Y. Bot. Gard.)." Type seen.

Rocky hillsides, frequently among shrubs, at altitudes of 1,900 to 3,000 meters; Montane, descending to upper Submontane Zone; flowering from late June to early August. Franklin Basin of southeastern Idaho, southward through the Wasatch region to Washington County, Utah.

IDAHO: Oneida: Franklin Basin, *C. P. Smith* 2278 (Y).

UTAH: Morgan: Peterson Canyon, *Pammel & Blackwood* 3866 (M). Salt Lake: Bingham Canyon (M); divide between Big Cottonwood Canyon and Heber Valley (U, Y); Diehls Grove, *Leonard* 179 (Y); Emigration Canyon, *Pennell* 5985 (D, F, H, P, U, Y); Parleys Canyon, *Pennell* 5953 (A, H, K, R, Y), 5961 (M, S, U, Y). Kane: *Siler* (A). Summit (?): Deer Creek, *Jones* (F, Y). Utah: Aspinwall Peak, American Fork Canyon, *Jones* (M, U). Washington: Pine Valley Peak, *Purpus* 6193 (U).

86. *Penstemon sepalulus* A. Nels.

Penstemon azureus ambiguus A. Gray, Syn. Fl. 2¹: 272. 1878. "Cañons of the Wahsatch Mountains, Utah, viz. of the Provo and American Fork, *Watson &c.*" Probable isotype, *Watson* 786, collected July, 1869, in Provo Canyon, seen in herbarium of the New York Botanical Garden.

Penstemon sepalulus A. Nels. in *Coulter, New. Man. Rocky Mount.* 444. 1909. "In the mountains of northwestern Colorado, in adjacent Utah and Wyoming." Based primarily upon *P. azureus ambiguus* A. Gray.

Rocky canyon sides, at altitudes of 1,500 to 1,800 (2,300) meters; Upper Sonoran and Submontane zones; flowering from mid-June to late July. Western slopes of Wasatch Mountains, central Utah.

UTAH: Salt Lake: *Garrett* 907 (Y). Utah: American Fork Canyon, *Jones* 1883 (F, U, Y); Kyune, *Jones* 5613e (U); Provo, near mouth of Provo Canyon, *Pennell* 6110 (A, D, H, K, M, P, R, S, U, Y), 6113 (Y); Slide Canyon, *Pennell* 6120 (F, Y).

The two following species have been detected in material recently examined by the writer.

25a. *Penstemon tidestromii* Pennell, sp. nov.

Stems one or several, 30 to 50 cm. tall, from a caudex, puberulent, glabrate above, glaucous; leaves pale dull green, somewhat glaucous, obscurely veined, puberulent, those at the base of the stem with oblanceolate obtuse (at times retuse) blades altogether 10 to 12 cm. long, 1 to 1.5 cm. wide, narrowed into petiole-like bases one-third the total length, the stem leaves similar, smaller, slightly clasping from a narrowed base (bases of opposite leaves not meeting around stem), becoming reduced and bractlike through the inflorescence; thyrsus narrow, secund, from one-third to two-thirds the

height of the plant, composed of (about) 9 to 15 fascicles, each of 2 short axillary branches, their pedicels (when in bloom) shorter than the peduncles; sepals 3 to 5 mm. long, narrowly ovate, acute to slightly acuminate, not veined, with no or narrow, slightly denticulate, scarious margin, glabrous or glabrate; corolla 15 to 20 mm. long the tube and throat 12 to 15 mm. long, the throat somewhat inflated and rounded ventrally, the 2 posterior lobes 3 to 5 mm. long, united and arched one-third to one-half their length, projecting, the 3 anterior lobes about equaling the posterior ones, united at base, the free portions spreading; corolla glabrous without and within, blue (not seen fresh); anther sacs widely divaricate, 1.6 to 1.8 mm. long, oblong-lanceolate, distinct, opening from distal apex nearly (or quite) throughout, glabrous; sterile filament equaling the anterior pair, scarcely enlarging distally, flattened, bearded with yellow hairs on the posterior face, more densely so distally; capsule not seen.

Type in the U. S. National Herbarium, no. 507825, collected in the oak zone, "XL" Canyon, San Pitch mountains, central Utah, altitude 1,650 meters, in flower, June 24, 1908, by Ivar Tidestrom (no. 1296).

"Occasional in the oak zone," at altitudes of 1,650 to 1,800 meters; Upper Sonoran Zone; flowering in June. Wasatch and San Pitch mountains of central Utah.

UTAH: San Pete: "XL" Canyon, San Pitch Mountains, *Tidestrom* 1296 (U); Ephraim Canyon, *Tidestrom* 1134 (U).

Related to *P. laevis* (p. 347) and *P. wardii* (p. 347), the three species to be distinguished as follows:

Corolla glandular-puberulent externally; sterile filament glabrous; plants 20 to 25 cm. tall, densely cinereous-puberulent. ***P. wardii*.**

Corolla glabrous externally; sterile filament bearded; plants 30 to 70 cm. tall, glabrous or finely puberulent.

Plant glabrous throughout; sepals 4 to 7 mm. long, conspicuously acuminate, with scarious dentate margins; corolla 20 to 30 mm. long; leaves at the base of the stem ovate, those on the stem conspicuously clasping by a rounded base ***P. laevis*.**

Plant puberulent; sepals 3 to 5 mm. long, acute or slightly acuminate, with margins slightly or not scarious; corolla 15 to 20 mm. long; leaves at base of stem oblanceolate, those on the stem narrowed to a slightly clasping base. . ***P. tidestromii*.**

35a. *Penstemon mensarum* Pennell, sp. nov.

Stem 40 to 50 cm. tall, from a slender caudex, finely glandular-pubescent in the inflorescence, slightly glaucous; leaves dull green, not glaucous, obscurely veined, glabrous, those at the base of the stem with oblong, obtuse to acutish blades 5 to 6 cm. long, narrowed into petiole-like bases about one-half length of blade, those of the stem similar, oblanceolate, the upper clasping (bases meeting around stem), the largest 8 cm. long, 1.5 cm. wide; thyrsus lax, secund nearly one-half height of plant, composed of at least 8 fascicles, each consisting of 2 axillary ascending branches; pedicels shorter than to equaling the peduncles, together reaching 20 mm. long; sepals 4 mm. long, oblong-ovate, acutish to acute, obscurely or not veined, proximally with obscure narrow whitish margin, finely glandular-pubescent; corolla 20 to 24 mm. long, the tube and throat 15 mm. long, the throat somewhat inflated and rounded ventrally, the 2 posterior lobes 4 mm. long, united and arched two-fifths their length, the free portions projecting, the 3 anterior lobes much longer, united at base, the free portions spreading; corolla externally glandular-puberulent, within glabrous, blue (not seen fresh); anther sacs widely divaricate, 1 mm. long, oblong-lanceolate, distinct, opening from the distal apex for nearly the entire length, pubescent on the side with slender white hairs, their length much less than the width of the sacs; sterile filament as long as the anterior pair, gradually enlarging distally, flattened, bearded on posterior face distally with scattered (or at apex dense) yellow hairs; capsule not seen.

Type in the U. S. National Herbarium, no. 1012411, collected on deep clayey loam, Battlement National Forest, Colorado, altitude 2,700 meters, in flower, July 15, 1912, by A. F. McDuffie (U. S. Forest Service, no. 7919).

To be placed in the key before *P. scariosus*, *P. garrettii*, and *P. cyanocaulis*, and to be separated as follows:

- Corolla glandular-puberulent externally; pedicels and sepals strongly glandular-pubescent; inflorescence laxer.....*P. mensarum*.
- Corolla glabrous externally; pedicels and sepals sparsely glandular-puberulent; inflorescence more congested.....*P. scariosus*, *P. garrettii*, *P. cyanocaulis*.

REVISION OF THE GENUS ACANTHOSPERMUM.

By S. F. BLAKE.

INTRODUCTION.

The genus *Acanthospermum*, a member of the Melampodioid *Heliantheae*, was established by Schrank in 1819 on the single species *A. brasilum*. In the following year the same species, which had been originally published by Loeffling in 1758 as *Melampodium australe*, was again described and figured as the type of a new genus, *Centrospermum*, in the *Nova Genera et Species* of Humboldt, Bonpland, and Kunth, and in 1825 it became the type of the genus *Orcya* of Velloso; while the genus *Echinodium* of Poiteau, published as a synonym by Cassini in 1829, was likewise based on this species. In De Candolle's *Prodromus*, in 1836, four species of *Acanthospermum* were recognized, divided between two sections based on the shape of the fruits. With the exception of two new species described from the Galapagos Islands by Robinson and Greenman, no other species of the genus have been published. In the present revision three new species from South America are described, bringing the total number of valid species in the genus to eight.

All the species of *Acanthospermum* are natives of America, but with their spiny *Xanthium*-like fruits they are easily transported, and two have reached the Old World as widespread if scattered introductions. *A. hispidum*, found in South America from Colombia and Venezuela to Argentina, and native over at least a part of this region, occurs as a weed in the southern United States as far north as New Jersey, in Honduras, Nicaragua, and the Lesser Antilles, and in Sénégal, Angola, Natal, and Hawaii. Gossweiler describes it in Angola as "a peculiar colonial weed appearing on waste places frequented by native carriers." *A. australe*, likewise occurring over essentially all of South America, and certainly a native of that continent, has been collected in the Lesser Antilles, the Hawaiian Islands, and India, and is becoming frequent along railroads in the southern United States occurring sporadically as far north as Massachusetts and Oregon. The fruits of this species, thickly covered with hooked prickles,

easily become entangled in the wool of sheep and are said to cause financial loss in the Southern States in this way, by lowering the quality of the wool. A third species, *A. humile*, originally described from Santo Domingo, is known as a presumptive native from the islands of the Greater Antilles, with the exception of Porto Rico, and occurs also in Panama and in Florida. In Florida it is of recent collection, and is certainly a weed of comparatively recent introduction. The first record for the species in Panama ¹ was from waste places, and subsequent collections are from similar situations, so that there can be little doubt that the plant is an introduction in that region also.

The five other species of the genus are each known from only one or at most two collections of specimens, all of which were with little doubt indigenous where found. The two most distinct of these come from Paraguay and the Galápagos Islands, respectively. Of the three other species, forming a very closely interrelated group, two are from Ecuador and one is from the Galápagos Islands, the latter not at all closely allied to the single other species of the islands.

SYSTEMATIC TREATMENT.

ACANTHOSPERMUM Schrank.

Acanthospermum Schrank, Pl. Rar. Hort. Monac. *pl.* 53. 1819.

Centrospermum H. B. K. Nov. Gen. & Sp. 4: 270. *pl.* 397. 1820.

Oreya Vell. Fl. Flum. 344. 1825; Fl. Flum. Icon. 8: *pl.* 83. 1827.

Echinodium Poit.; Cass. Dict. Sci. Nat. 59: 235. 1829, as synonym.

Pubescent dichotomous annuals, with opposite, subentire to pinnatifid leaves and small, sessile or short-peduncled heads solitary in the axils and forks of the stem: heads heterogamous, radiate, the ray flowers 5 to 8, 1-seriate, fertile, those of the disk 5 to 30, sterile; proper involucre of 4 to 6 elliptic to ovate, herbaceous, 1-seriate phyllaries; inner phyllaries of the same number as the ray achenes and closely enveloping them, enlarged in fruit; receptacle small, convex, the pales membranous, concave, subtending the disk flowers, more or less persistent; ray corollas ligulate, small or medium, elliptic to ovate, emarginate or tridenticulate, the tube as long as or much shorter than the limb, pale yellow; disk corollas yellowish, with short cylindric tube, cylindric-funnelform or campanulate throat, and 5-lobed limb; anthers barely cordate to cordate-sagittate at base, the appendage ovate, obtuse, somewhat inflexed; style of ♂ flowers clavate, obtuse, undivided, hispidulous; fruit (achenes of the ray with their closely enveloping indurate phyllaries) cuneate or oblong-fusiform, rarely trigonous-turbinate, weakly or strongly laterally compressed, more or less densely echinate on the whole surface, the angles, or rarely only at apex, with straightish or usually uncinuate prickles, those at the apex of fruit usually elongate; pappus none.

Type species, *A. brasilum* Schrank, which is *A. australe* (Loefl.) Kuntze.

¹ Steetz; Seem. Bot. Voy. Herald 155. 1854.

KEY TO SPECIES.

Leaves pinnatifid; fruit trigonous-turbinate, with 4 or 5 spines at summit, smooth on sides; ligules 7.5 mm. long. Section LECOCARPOPSIS Blake.

1. *A. lecocarpoides*.

Leaves lyrate-lyrately repand-dentate to subentire; fruit spiny at least on the angles, as well as at apex; ligules 1 to 1.5 mm. long.

Fruit strongly compressed, cuneate in outline, obscurely ribbed, the two terminal prickles largest; heads usually sessile. Section CERATOCHLAENA DC.

Terminal prickles slender-subulate, terete or very slightly flattened, about as long as the body of the fruit.

Leaves with ovate or oval blade, abruptly contracted into a distinctly petiolar winged base..... 2. *A. humile*.

Leaves oval or obovate, gradually narrowed to the base.... 3. *A. hispidum*.

Terminal prickles lanceolate or lanceolate-subulate, more or less flattened, much shorter than the body of the fruit.

Body of fruit (excluding the terminal prickles) 3.5 to 3.8 mm. long. 4. *A. donii*.

Body of fruit 4 to 5 mm. long.

Body of fruit 5 mm. long..... 5. *A. simile*.

Body of fruit 4 to 4.5 mm. long..... 6. *A. microcarpum*.

Fruit oblong-fusiform or oblong-obovate in outline, slightly compressed, strongly ribbed; heads (at least those in the forks) peduncled. Section XANTHOIDES DC.

Fruit sharply 2-beaked..... 7. *A. consobrinum*.

Fruit obtuse, with open orifice at apex..... 8. *A. australe*.

1. *Acanthospermum lecocarpoides* Robins. & Greenm. Amer. Journ. Sci. III. 50: 141. 1895. PLATE 23, a.

Erect, sparsely branched, 28 cm. high; stem fuscous, densely stipitate-glandular and hispid with short several-celled spreading hairs, subglabrate below; leaf blades 4.5 to 9 cm. long, 2.2 to 4.5 cm. wide, ovate in outline, divided to middle or deeper into 6 to 8 pairs of ovate to obovate lobes, these lacinate above the middle or pinnatifid nearly to base with somewhat revolute divisions, densely hispidulous-glandular above, beneath equally green, hispidulous along the nerves and glandular elsewhere, pinnate-veined, narrowed at base into the petiole; petioles margined above, glandular-hispidulous, 1.5 to 2.5 cm. long; heads solitary in the forks of the stem, 1.8 to 2.5 cm. wide; peduncles densely glandular-hispidulous, 2.3 to 4.5 cm. long; phyllaries 4, ovate, acute, hispidulous on both sides with glandular-tuberculate hairs and glandular, crenate-serrate, united at base, 9 to 10 mm. long; ray flowers about 6; rays ligulate, yellowish, oblong-elliptic, tridenticulate, about 9-nerved, stipitate-glandular dorsally, merely closed in a ring at base without proper tube, 7.5 mm. long, 2.2 mm. wide; disk corollas about 30, glandular, the tube cylindric, 1.5 mm. long, the throat campanulate, scarcely broader, 0.7 mm. long, the 5 teeth erect, lanceolate, subacuminate, 1 mm. long; stamens strongly sagittate at base; pales slender, acuminate, densely stipitate-glandular, 4 mm. long; fruit trigonous-turbinate, somewhat gibbous above the middle, densely stipitate-glandular and hispidulous with several-celled glandular-based hairs, the body 5 to 5.5 mm. high, 4.5 to 5 mm. wide, bearing around the rounded apex 4 or 5 slender-subulate, wide-spreading, straight or somewhat curved horns 3 to 7 mm. long, the two on the inner angles always present, that on the outer angle sometimes obsolete.

TYPE LOCALITY: Hood Island, Galápagos Islands.

SPECIMENS EXAMINED:

GALÁPAGOS ISLANDS: Hood Island, July, 1891, *Baur* 128 (type, G²); May, 1899, *Snodgrass & Heller* 744 (G).

² The following abbreviations are used to indicate the herbaria in which specimens are deposited: B, British Museum; Ber., Royal Herbarium, Berlin; G, Gray Herbarium; K, Kew Herbarium; N, U. S. National Herbarium; Prod., Prodrum Herbarium.

This very distinct species closely simulates the monotypic genus *Lecocarpus*, also endemic in the Galápagos Islands (on Chatham and Charles islands), but is at once distinguishable by the lack of the broad spreading circular border which terminates the fruiting phyllaries in that genus. *A. lecocarpoides* has been recorded by Stewart³ from Sappho Cove on Chatham Island.

2. *Acanthospermum humile* (Swartz) DC. Prodr. 5: 522. 1836. PLATE 23, b.

Melampodium humile Swartz, Prodr. Veg. Ind. Occ. 114. 1788.

Centrospermum humile Less. Syn. Gen. Compos. 217. 1832.

Acanthospermum humile α *normale* Kuntze, Rev. Gen. Pl. 1: 303. 1891.

Much branched, erect or decumbent, 30 cm. long or more; stem fuscous, densely puberulous and hispid-pilose with many-celled spreading hairs; leaf blades 1 to 2.8 cm. long, 1 to 3.3 cm. wide, ovate or deltoid-ovate, obtuse or acutish, abruptly narrowed into a margined petioliform base, irregularly crenate-dentate or repand-serrate, gland-dotted and hispid-pilose particularly along the veins on both sides, slightly paler beneath, the irregularly serrulate, lobulate, or entire, petioliform, margined base 4 to 18 mm. long; heads solitary in the axils and forks of the stem, sessile or on peduncles 3 mm. long or less, 3.5 to 4 mm. wide in anthesis, 12 to 15 mm. in fruit; outer phyllaries 5, oval, acutish, 3-nerved, hispid-pilose chiefly on margin, 2.5 mm. long, 1 mm. wide; ray flowers 5 to 7, their corollas erect, pale yellowish, oval, emarginate, hispid-pilose, 1.3 mm. long, about equaled by the style, with very short tube; disk corollas 5, stipitate-glandular and sparsely hispid-pilose, 1.4 mm. long; pales emarginate, lacerate at apex, 1.3 mm. long; fruit cuneate, compressed-trigonus, gland-dotted and more or less pilosulous, uncinately prickly on the angles and the apical margin, the sides unarmed or with a few sparse prickles, the body 3 mm. long, the two large terminal prickles (one usually straight, one uncinately) 2 to 3 mm. long.

TYPE LOCALITY: "Jamaica, Domingo."

SPECIMENS EXAMINED:

FLORIDA: Ballast wharf, Pensacola, August, *Curtiss* 1491* (N).

CUBA: Weed, Laguna Jovero and vicinity, 1911, *Shafer* 10968 (N), 10985 (N).

Open places in thicket, valley of Río Bacuranao, Havana, 1912, *Wilson & León* 11605 (N). Vicinity of Vento, Havana, 1904, *Wilson* 1328 (N). Roadside near La Gloria, Camaguey, 1909, *Shafer* 321 (N). Maisi to Sabana, Oriente, 1910, *Shafer* 7936 (N). Without definite locality, *Wright* 311 (N). Nueva Gerona, Isle of Pines, 1904, *Curtiss* 361 (N).

JAMAICA: Green Valley, altitude 610 meters, 1895, *Harris* 5733 (B). Sand near beach, Long Acre Point, west of Black River, 1907, *Harris* 9964 (B, N). Without definite locality, *Dr. Wm. Wright* (B).

SANTO DOMINGO: Paradis, Province of Barahona, 1909, *Türckheim* 2709 (N); in 1911, *Fuertes* 1100 (N). Without definite locality, *Swartz* (B).

PANAMA: Boca Chica de Horconcitos, Chiriquí, 1911, *Pittier* 5123 (N). Chagres, 1850, *Fendler* 171 (N). Along beach between Fató and Playa de Damas, Province of Colón, 1911, *Pittier* 3833 (N). Waste places about Panama, July, 1862, *Hayes* (B). Without definite locality, *Hayes* 198 (B); *Seemann* 296 (B).

CULTIVATED: Kew Gardens, 1784 (B).

Swartz,⁴ in his amplified description of this species, remarks: "Planta agricolis odiosa; et semina pullis Gallinarum et Meleagridum obnoxia."

3. *Acanthospermum hispidum* DC. Prodr. 5: 522. 1836.

PLATE 23, c.

Acanthospermum humile β *hispidum* Kuntze, Rev. Gen. Pl. 1: 303. 1891.

Erect, 20 to 55 cm. high, dichotomous; stem stout, striatulate, hispid-pilose with spreading many-celled hairs, sordid-puberulous between them; leaf blades 2 to 12.5 cm. long, 0.8 to 8 cm. wide (including the cuneate base), elliptic to ovate or

³ Proc. Calif. Acad. IV. 1: 148. 1911.

⁴ Fl. Ind. Occ. 3: 1371. 1806.

deltoid-ovate, acute to obtuse, mucronulate, gradually cuneate below the middle into a sessile base (those of the pairs united), serrulate or doubly repand-serrate to subentire, rather sparsely hispid-pilose on both sides, gland-dotted and slightly paler green beneath; heads solitary in the axils and forks of the stem, in anthesis 4 to 5 mm. wide, in fruit 13 to 18 mm.; peduncles 3 to 15 mm. long; outer phyllaries 5, ovate or narrowly elliptic-ovate, acutish, hispid-pilose mainly on the margin, 3.5 to 4 mm. long; ray flowers 5 to 8, their corollas pale yellow, elliptic, tridenticulate at the slightly spreading apex, sparsely hispid-pilose, half longer than the style, 1.5 mm. long; disk corollas about 7, shortly hispid-pilose, 1.7 mm. long; pales stipitate-glandular on back, lacerate-ciliate at the subtruncate apex, 2 mm. long; fruit cuneate, strongly compressed, gland-dotted, rather densely uncinat-hispid all over the body, 4 to 5 mm. long, the two terminal straightish or curved, strongly divergent prickles 3 to 4 mm. long; sterile ovaries stipitate-glandular.

TYPE LOCALITY: "In Brasiliae sabulosis maritimis circa Bahiam." Type collected by Salzmann.

ILLUSTRATIONS: Engl. & Prantl, *Pflanzenfam.* 4⁵: f. 108, *M*; Proc. Amer. Acad. 38: pl. 1, f. 4.

SPECIMENS EXAMINED:

NEW JERSEY: Ballast grounds, Camden, 1879, *Martindale* (N).

GEORGIA: Waste places and roadsides, Darien, 1903, *Harper* 1999 (N).

FLORIDA: Ballast ground, Pensacola, 1880, *Mohr* (N); in 1899, *Curtiss* 6501 (N).

ALABAMA: Ballast ground, Mobile, 1893, *Mohr* (N).

SALVADOR: Without definite locality, *Velasco* (J. D. Smith, no. 8884; N); *Renson* 183 (N).

HONDURAS: San Pedro Sula, Santa Bárbara, altitude 200 meters, 1889, *Thiëme* (J. D. Smith, no. 5296; N).

NICARAGUA: Roadsides, Grenada, 1869, *Lévy* 228 (K).

CULEBRITA: Waste places, Culebrita, 1906, *Britton & Wheeler* 280 (N).

ST. THOMAS: In 1880, *Eggers* 3 (K).

ST. JOHN: Roadside, Bethania to Rosenberg, 1913, *Britton & Shafer* 252 (N).

TORTOLA: Rocky hill, Road Town to Sea Cow Bay, 1913, *Britton & Shafer* 672 (N).

VIRGIN GORDA: Roadside near Valley, 1913, *Britton & Fishlock* 1099 (N).

ST. CROIX: Bassin pasture, 1895, *Ricksecker* 20 (N).

MONTSERRAT: Richmond, 1907, *Shafer* 127 (N).

GUADELOUPE: Lowlands, Galisbi, 1904, *Duss* 4203 (N).

TOBAGO: Roadside, Bethesda, 1909, *Broadway* 3141 (B).

COLOMBIA: Anapoima, Magdalena, altitude 500 meters, *Triana* 1332 (B, K).

El Overo, Cauca, 1853, *Holton* 358 (K). Without definite locality, *Linden* 1378 (B, K).

VENEZUELA: Weed, near Caracas, *Ernst* (Moritz, no. 1500; B). *Tovar*, 1856-57, *Fendler* 1969 (K).

PERU: Lima, *Cuming* 987 (K). Callao, *Wilkes Expedition* (G, N).

BOLIVIA: Bolivian Plateau, 1891, *Bang* 1137 (N). Guanai to Tipuani, 1892, *Bang* 1445 (N). Province of Larecaja, *Mandon* 31 (B, K, G). Dry sunny field, Tarija, 1902, *R. E. Fries* 1056 (N). Corral, Velasco, altitude 200 meters, 1892, *Kuntze* (N). Open grassy pampas, Carrapari, May, 1864, *Pearce* (B).

BRAZIL: Waste ground in village, Fernando do Noronha, 1887, *Ridley, Lea & Ramage* 105 (B, K). Pernambuco, 1887, *Ridley, Lea & Ramage* (B). Maçino, Province of Alagoas, 1838, *Gardner* 1345 (B, K). Oeiras, Province of Piahy, 1839, *Gardner* (B). Province of Bahia, *Salzmann* 21 (K); *Gardner* 869 (B); *Glocker* (B, K). Arrayas, Province of Goyaz, 1840, *Gardner* 3842 (B, K.), Cuyacá, Province of Matto Grosso, 1893, *Malme* 1266 (B). Province of

Minas Geraes, *Claussen* (B). Piracicaba, Province of Sao Paulo, 1894, *Campos Novaes* (N). Without definite locality, *Sello* (K); *Martius* 645 (K); *Gardner* 2211 (B).

PARAGUAY: L'Assomption, 1874, *Balansa* 874 (K). Central Paraguay, 1888-90, *Morong* 162 (N). Cordillera de Altos, 1903, *Fiebrig* 1000 (G, K). San Bernardino, *Hassler* 3895 (G).

ARGENTINA: Tucumán, *Lorentz & Hieronymus* 90 (K). Córdoba, 1878, *Hieronymus* (B, K). Estancia Germania near Córdoba, 1874, *Lorentz* 37 (B). Buenos Aires, *Tweedie* 739 (K). Province of Catamarca, 1915, *Jørgensen* 1093 (G).

SÉNÉGAL: In 1906, *Farmar* 16 (K).

ANGOLA: "A peculiar colonial weed, appearing on waste places frequented by native carriers," N'Dalatando Cazengo, 1912, *Gossweiler* 5541 (B).

NATAL: Durban, 1910, *Franks* (Wood, no. 11676) (K).

HAWAIIAN ISLANDS: Hawaii, 1851-55, *Rémy* 256 (G).

From its only near relative, *A. humile*, this much more widely distributed species is easily distinguished by its cuneate-based, not distinctly petioled leaves, and by its fruits, which are rather densely uncinatate on the sides as well as on the angles. Its local name in Matto Grosso is given by Malme as "carapicho." In Ceará it is known as "retirante," and an infusion of the root is used as a remedy for coughs and bronchitis.⁵

4. *Acanthospermum donii* Blake, sp. nov.

PLATE 23, d.

Herbaceous, branching, 30 cm. high and more, the base not seen; stem compressed, striatulate, whitish, pilose with spreading whitish hairs and puberulous between them with closely appressed hairs, glabrate below; leaf blades 3.5 to 8 cm. long, 1.5 to 4 cm. wide, rhombic-oval or broadly obovate, obtuse, gradually narrowed into a cuneate base, subsessile, repand-dentate (the teeth about 9 to 15 pairs, depressed, scarcely mucronulate), triplinerved above the base, green on both sides and rather sparsely pilose, the hairs longer along the veins; heads solitary in the axils and the forks of the stem, subsessile or on very short (1.5 mm. long) peduncles, in anthesis 6 to 8 mm., in fruit 9 to 11 mm. thick; outer phyllaries 4 or 5, oblong or obovate, obtuse, herbaceous, pilose-ciliate, united at extreme base, 3-nerved, 3.5 to 4.5 mm. long, 1 to 2.3 mm. wide; ray corollas about 8, yellow, oval, emarginate, 1 mm. long; disk corollas about 14, pale yellow, sparsely pilose and glandular, 1.8 mm. long (tube 0.6 mm.), the throat obscure, the teeth ovate; fruit cuneate, strongly compressed, 4 mm. high, 1 mm. wide at base, 3.5 to 4 mm. wide across the spines at apex, the body (exclusive of the terminal spines) 3.5 to 3.8 mm. long, whitish, with a short conic-subulate compressed spine on the inner angle and a longer one on the outer, 1-ridged on inner face, with sparse subulate uncinatate-tipped aculei on the sides and back.

Type in the British Museum, from the herbarium of Ruiz and Pavón, collected in Ecuador (?). Fragments of type in Gray Herbarium.

The type specimens in the British Museum, labeled as of Mexico but certainly from South America and probably from Ecuador, were marked by David Don many years ago as a new species of *Melampodium*, under a name which would be in no way distinctive in *Acanthospermum*.

5. *Acanthospermum simile* Blake, sp. nov.

PLATE 23, e.

Subsimple or dichotomous annual, at length 1 meter long; stem subcompressed, striate, whitish, rather densely pilose with loosely spreading, many-celled hairs, and between them closely appressed-pilosulous; leaf blades 3.5 to 7.7 cm. long, 3 to 3.8 cm. wide, rhombic-ovate or rhombic-oval, obtuse, gradually narrowed below the

⁵ Dias da Rocha, Bot. Med. Cear. 98. 1919.

middle into a margined petioliform base, sessile, obscurely repand, triplinerved above the base, green on both sides and rather sparsely pilose, the hairs longer and spreading along the veins, elsewhere more or less appressed; heads solitary in the axils and forks of the stem, sessile, 10 to 11 mm. thick in fruit; outer phyllaries 5, oblong or oblong-oval, rounded at apex, herbaceous, pilose-ciliate and on back sparsely pilose, 4.5 to 5 mm. long, 1.5 to 2 mm. wide; ray corollas about 10, yellow, oval, emarginate, 1 mm. long; disk corollas about 13, yellowish, sparsely pilose and glandular; fruit cuneate, compressed, flattened and 1-ridged on inner angle, 5.5 mm. long, 1 mm. wide at base, 4.8 mm. wide across the tips of the spines, the body (exclusive of the terminal spines) 5 mm. long, dull or greenish white, gland-dotted, with a short lanceolate compressed spine on the inner angle at apex and a longer lanceolate-subulate one on the outer, bearing about 2 stout aculei on the dorsal angle, on margin of inner angle, and at apex, the sides bearing 2 to 4 weak prickles.

Type in the British Museum, collected on savannas near the River Daule, near Guayaquil, Ecuador, by R. Spruce (no. 6307). Fragments of type in the Gray Herbarium.

Closely related to the last preceding species, which probably comes from essentially the same region, but distinguished by its larger fruit. The type collection was distributed as *Acanthospermum xanthioides* DC. (*A. australe*), an unrelated species. Two of the fruits are sometimes connate into one.

6. *Acanthospermum microcarpum* Robinson, Proc. Amer. Acad. 38: 208. pl. 1, f. 3. 1902. PLATE 23, f.

Erect, branching, 30 cm. high; stem stoutish, rather densely hirsute-pilose with several-celled wide-spreading hairs, in age glabrate; leaf blades 2.6 to 4.3 cm. long, 1 to 1.8 cm. wide, rhombic or rhombic-ovate, obtuse, abruptly or gradually contracted below the middle into a cuneate sessile base, crenate-serrate above the base, 3-nerved, rather sparsely hirsute-pilose on both sides with several-celled ascending hairs, gland-dotted beneath; heads sessile or subsessile in the forks of the stem and in the axils, 9 mm. wide in fruit; phyllaries 4 to 6, elliptic or oblong-elliptic, obtuse or acutish, hispid-pilose-ciliate and sparsely hispid-pilose on back, 3.5 to 4.5 mm. long; ray corollas 8, yellowish white, quadrate-oval, tridentate, glandular on back, 1 mm. long; disk corollas 8, 1.2 to 1.5 mm. long, the slender tube and short-campanulate throat 0.5 to 0.7 mm. long, sparsely hispid-pilose with several-celled hairs and gland-dotted, the 5 teeth ovate, acutish, spreading, sparsely hispid and gland-dotted; anthers cordate-sagittate at base; united style branches of ♂ flowers clavate, obtuse, hispidulous above; pales obovate, concave, lacerate at the obtuse apex; fruit trigonous-cuneate, compressed, 4.8 to 5.5 mm. high, 4 to 4.3 mm. wide across the tips of the spines, the body (exclusive of the terminal spines) 4 to 4.5 mm. long, with 2 lance-subulate, slightly compressed, straight or slightly curved spines at apex, gland-dotted, about 3-nerved on the sides, bearing mostly above middle on back and on sides toward apex a few subulate, straightish or slightly uncinat aculei.

TYPE LOCALITY: Charles Island, Galápagos Islands.

SPECIMEN EXAMINED:

GALÁPAGOS ISLANDS: Charles Island, May, 1899, *Snodgrass & Heller* 446 (type; G).

Acanthospermum microcarpum is intermediate between *A. donii* and *A. simile*, both of Ecuador, but is distinguished by the size of its fruit.

7. *Acanthospermum consobrinum* Blake, sp. nov. PLATE 23, g.

Branched procumbent "annual," 30 cm. long and more, the base not seen; stem subterete, striate, whitish, glandular-puberulous and pilose with loosely spreading shining many-celled hairs; leaf blades 1.7 to 2.5 cm. long, 6 to 12 mm. wide, obovate or rhombic-obovate, obtuse, cuneate into a sessile base, dentate above the middle (teeth 2 to 4 pairs, triangular, more or less depressed), triplinerved above the base, green on both sides and sparsely pilose with more or less appressed hairs, those along

the midrib longer and spreading; heads solitary in the axils and the forks of the stem, in anthesis 7 mm., in fruit about 1.8 cm. thick; peduncles curved, 3 to 4 mm. long; phyllaries 4 or 5, ovate to oblong-ovate, obtusish, herbaceous, 3-nerved, pilose-ciliate, 4 to 5 mm. long, 1.8 to 2.5 mm. wide; ray corollas about 7, yellowish, oblong-oval, tridenticulate, sparsely glandular, 1 mm. long; disk corollas about 7, yellowish, glandular and pilose on the tube (1 mm. long), sparsely glandular on the teeth, 2.5 mm. long; fruit obovoid-fusiform, distinctly compressed, 9.5 to 10 mm. long, whitish, gland-dotted, 2-beaked at apex, the outer beak curved, slender-subulate, the inner longer and straight, grooved on its inner face, the body acute at base, 3 to 3.3 mm. wide above the middle, about 8-ridged, the ridges bearing firm glochidiate-tipped aculei, those on the margins of the outer angle the longest (3 to 3.5 mm. long).

Type in the British Museum, collected in waste lands, L'Assomption, Paraguay, April 6, 1874, by Balansa (no. 874a). Fragments of type in the Gray Herbarium.

This species is at once recognizable by its fruit, which is to a slight degree intermediate between that of *A. australe* and that of the section *Ceratochlaena*.

8. *Acanthospermum australe* (Loefl.) Kuntze, Rev. Gen. Pl. 1: 303. 1891.

PLATE 23, h-m.

Melampodium australe Loefl. Iter Hisp. 268. 1758.

Acanthospermum brasiliun Schrank, Pl. Rar. Hort. Monac. pl. 53. 1819.

Centrospermum xanthioides H. B. K. Nov. Gen. & Sp. 4: 271. pl. 397. 1820.

Orcya adhaerescens Vell. Fl. Flum. 345. 1825; Fl. Flum. Icon. 8: pl. 83. 1827.

Echinodium prostratum Poit.; Cass. Dict. Sci. Nat. 59: 245. 1829, as synonym.

Acanthospermum xanthioides DC. Prodr. 5: 521. 1836.

Acanthospermum xanthioides α *obtusifolium* DC. Prodr. 5: 522. 1836.

Acanthospermum xanthioides β *acutifolium* DC. Prodr. 5: 522. 1836.

Acanthospermum xanthioides γ *glabratum* DC. Prodr. 5: 522. 1836.

Acanthospermum hirsutum DC. Prodr. 5: 522. 1836.

Procumbent or creeping, 60 cm. long or more; stem compressed, whitish, short-pilose with oblique many-celled hairs; leaf blades 1.3 to 3.7 cm. long, 0.7 to 3.2 cm. wide, rhombic-ovate or triangular, acute to obtuse, cuneate into the narrowly margined petiole, triplinerved, irregularly dentate-serrate above the cuneate entire base with callous-tipped teeth, sparsely appressed-pilosulous, dotted with impressed glands, particularly beneath; petioles 3 to 15 mm. long; heads solitary in the axils and at apices of stem and branches, in anthesis 6 to 7 mm., in fruit 1.5 to 2 cm. wide; peduncles sordidly hispid-pilose, 1.5 cm. long or less; outer phyllaries 5, oval or elliptic, obtusish, herbaceous, 3-nerved, ciliate and on back sparsely pilose, 3 to 4 mm. long; ray corollas 5 to 8, yellowish, densely stipitate-glandular, 1 mm. long, the erect limb 3-toothed; disk corollas about 12, yellowish, pilose below, glandular above, 2.5 mm. long (tube 1 mm., teeth 0.8 mm. long); pales scarious, glandular and ciliate, fimbriate-ciliate at the deeply emarginate apex, 2.5 mm. long; fruit obliquely ellipsoid-fusiform, slightly compressed, 5 to 7-ribbed, with open orifice at the obtuse apex, 7 to 8.5 mm. long, densely glandular, the ribs bearing 1 or 2 rows of ascending uncinat pricks 1 to 2 mm. long.

TYPE LOCALITY: Vicinity of Barcelona, Venezuela. Type collected by Loeffling, February 15, 1755.

ILLUSTRATIONS: Schrank, Pl. Rar. Hort. Monac. pl. 53; H. B. K. Nov. Gen. & Sp. 4: pl. 397; Lam. Tabl. Encycl. pl. 988; Vell. Fl. Flum. Icon. 8: pl. 83; Britt. & Brown, Illustr. Fl. ed. 2. 3: f. 4420.

SPECIMENS EXAMINED:

MASSACHUSETTS: Lawrence, 1906, *Mrs. E. Schneider* (G).

VIRGINIA: Well established near Alexandria, 1912, *Summers* (N).

NORTH CAROLINA: Raleigh, 1880, *Hyams* (N). W. & W. Railroad near Goldsboro, 1890, *Coville* 48 (N). Streets of Wilmington, 1879, *Hyams* (N).

SOUTH CAROLINA: Streets, Blufftown, *Mellichamp* (B).

- GEORGIA: Along railroad near Rocky Face, Whitfield County, 1900, *Harper* 290 (N). Stone Mountain, 1893, *Small* (N); in 1897, *Eggert* (N); in 1900, *Pollard & Maxon* 471 (N). Abundant in sandy soil along railway, Godwinsville, 1901, *Dewey* 545 (N).
- FLORIDA: Jacksonville, *Curtiss* 1491, 4476, 5515 (N); in 1899, *Pieters* 22 (N). Gainesville, 1876, *Garber* (N). Along railroad, Eustis, 1894, *Nash* 724 (N). Clarcona, Orange County, 1899, *Meislahn* 128 (N). Dunedin, 1900, *Tracy* 6918 (N). Cedar Keys, 1874, *Palmer* 273 (N). Common along Chattahoochee River, 1897, *Bush* 18 (N). Apalachicola, 1890, *Biltmore Herbarium* 107a (N).
- ALABAMA: Tuscaloosa, *Mohr* (N). Waste places in sandy soil, Ozark, 1880, *Mohr* (N). Grandbay, Mobile County, 1879, *Mohr* (N).
- TENNESSEE: Along railroad, Tellico Junction, 1894, *Bain* (N).
- MISSISSIPPI: Scranton, 1898, *Tracy* 4837 (N).
- LOUISIANA: Port Eads, 1900, *Tracy & Lloyd* 517 (N).
- OREGON: Ballast, Linton, 1916, *J. C. Nelson* 975 (G).
- MARTINIQUE: *Sieber* 204 (G; distributed as *Siegesbeckia flosculosa*); in 1868, *Hahn* 409 (B; distributed as *Siegesbeckia flosculosa*).
- ST. VINCENT: *Alex. Anderson* (B).
- GRENADA: *Thomson* (B).
- COLOMBIA: Villarica, altitude 450 meters, *Triana* 1333 (B). Upata, *Otto* 1018 (G).
- VENEZUELA: Caracas, *Moritz* 206, 691 (B). Road from Caracas to La Guayra, altitude 1,100 to 1,700 meters, 1913, *Pittier* 5874 (N). Cerro del Gelipán, altitude 1,370 meters, 1891, *Eggers* 13233 (N).
- BRITISH GUIANA: 1838-39, *Schomburgk* 663 (B, N); in 1841, *Schomburgk* "195 (144)" (B, N).
- FRENCH GUIANA: Karouany, 1857, *Sagot* 349 (B). Without definite locality, *Poiteau* (B).
- BOLIVIA: Yungas, 1890, *Bang* 324 (N). Cochabamba, 1891, *Bang* 884 (N). Maipiri, altitude 1,525 meters, 1886, *Rusby* 1348 (N). Coroico, 1866, *Pearce* (B).
- BRAZIL: Near Para, 1850-51, *Spruce* (B). District of the Rio Plata, Province of Pernambuco, 1839, *Gardner* 2902 (B), 2903 (K). Province of Bahia, *Salzmann* 38 (K); *Sello* 583 (K); in 1817, *Lockhart* (B); in 1842, *Glocker* 33 bis (B). Chapada, Province of Goyaz, 1840, *Gardner* 3297 (B). Santa Cruz, Province of Matto Grosso, 1891-92, *S. L. Moore* 761 (B). Province of Rio de Janeiro, *Gaudichaud* (K); *MacGillivray* 317 (K); *Glaziou* 13999 (K); *Miers* 3019 (K); *Gardner* 57 (K); *Wilkes Expedition* (N). Porto Alegre, Province of Rio Grande do Sul, 1892, *Malme* 276 (B).
- PARAGUAY: On termite hills of yellow loam, between Río Apa and Río Aquidaban, Villa Sana, 1908-09, *Fiebrig* 5204 (B). Cerro de Tobati, *Fiebrig* 744 (K). Cordillera Central, 1897, *Hassler* 3882 (B); in 1900, *Hassler* 7045 (B). South Paraguay, 1892, *Kuntze* (N).
- URUGUAY: Concepción, 1877, *Lorentz* 951 (B).
- HAWAIIAN ISLANDS: Diamond Head, Oahu, 1895, *Heller* 2030 (B, N).
- INDIA: Singapore, 1861, *T. Anderson* 52 (B). Ang Mo Ko, Singapore, 1891, *Ridley* 2740 (B).

This species, which is commonly known as "Paraguay bur" or "sheep bur," has spread throughout most of the Southern States, especially along railroads, and occurs sporadically on waste heaps and ballast as far north as Massachusetts and Oregon. An account of the plant by J. P. Berckmans, which appeared in the Bulletin of the

Torrey Botanical Club many years ago,⁶ contains the earliest record available of the presence of the Paraguay bur in the United States and is of sufficient interest to be reproduced here.

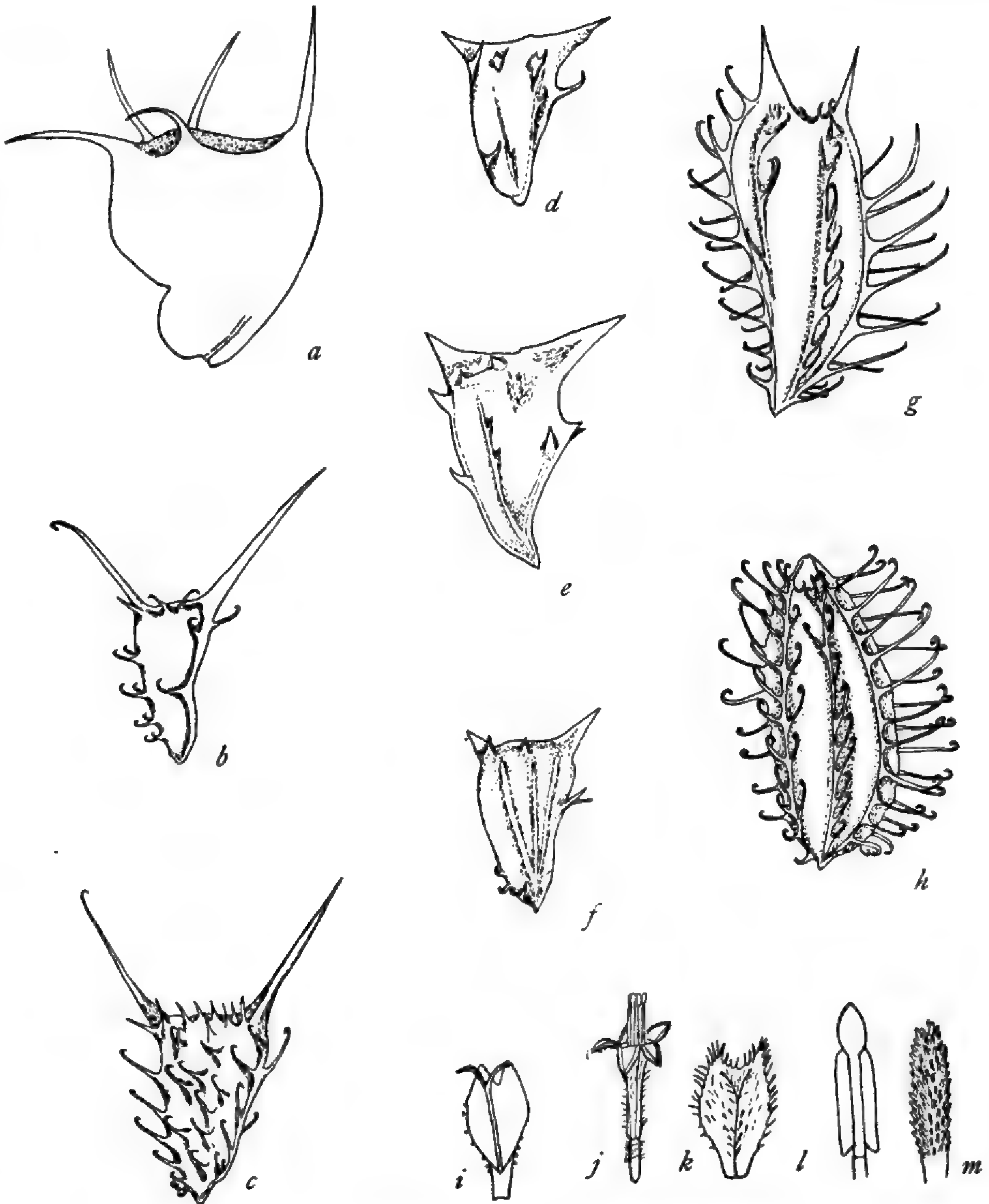
"ACANTHOSPERMUM XANTHOIDES.—About the year 1851 the then existing factory of Belleville, a few miles from Augusta [Georgia], received a quantity of wool imported from Buenos Aires. This wool was found to contain great numbers of small burs, which were separated by the picking machine, and the 'trash' was thrown outside of the picker room. The following year there sprang up innumerable plants of a spreading habit, which covered the ground all around the factory, and in a very few years the surrounding country was filled with the plant. The hooks upon the involucre allow the heads, or burs, to attach themselves to the legs of cattle, and in this way the seeds are carried about and widely scattered.

"I first saw the plant in 1857, when it made its appearance on my place simultaneously with *Lespedeza striata*, and I attribute its introduction here to the servants, who formerly had frequent intercourse with those at the Belleville factory. I have seen the plant in numerous places along the South Carolina Railroad, and there is scarcely a roadside within many miles of Augusta, if the soil is sandy, that is free from this plant. While it seems to prefer sandy localities, it will grow quite as luxuriantly on clay soils. Mr. Ravenel gave me its name many years ago."

The vernacular name of this species in Brazil is given by Baker as "carrapicho" or "carapixo."

EXPLANATION OF PLATE 23.—*a*, fruit of *Acanthospermum leocarpoides*, Baur 128, scale 4.5; *b*, fruit of *A. humile*, Pittler 5123, scale 4.5; *c*, fruit of *A. hispidum*, Britton & Fishlock 1099, scale 4.5; *d*, fruit of *A. donii*, Ruiz & Pavón, scale 4.5; *e*, fruit of *A. simile*, Spruce 6307, scale 4.5; *f*, fruit of *A. microcarpum*, Snodgrass & Heller 446, scale 4.5; *g*, fruit of *A. consobrinum*, Balansa 874a, scale 4.5; *h*, fruit of *A. australe*, Bang 884, scale 4.5; *i*, ray corolla of *A. australe*, Curtiss 1491, scale 10; *j*, disk flower of *A. australe*, scale 5; *k*, pale of *A. australe*, flattened and viewed from back, scale 5; *l*, anther of *A. australe*, scale 10; *m*, apex of style of hemaphrodite flower of *A. australe*, scale 10.

⁶ Bull. Torrey Club 6: 90. 1876.



FRUITS AND FLORAL DETAILS OF ACANTHOSPERMUM.

REVISION OF THE GENUS FLOURENSIA.

By S. F. BLAKE.

INTRODUCTION.

The genus *Flourensia*, established by De Candolle¹ in 1836 to include a Chilean plant described by Molina as a *Helianthus* and three new species, was divided by him into two groups—one, Chilean, including the two radiate species *F. thurifera* (Mol.) DC., with a variety *angustifolia* DC., and *F. corymbosa* (a true *Viguiera*); the other, Mexican, with the two discoid species *F. laurifolia* and *F. cernua*, both based on Berlandier's collections. In the Genera Plantarum of Bentham and Hooker² *Flourensia* was included under *Helianthus* with some mention of its peculiarities, while *F. corymbosa* was relegated to *Viguiera*. In 1883 Gray³ discussed the genus, considering the discoid species typical, suggesting that *F. thurifera* might be included as a section "under Bertero & Colla's name (not Cassini's) of *Diomedea*"⁴ and giving the new name *Viguiera poeppigii* to *F. corymbosa*. The genus was again referred to *Helianthus* by Baillon⁵ in 1886, but was recognized as distinct by Hoffman⁶ in 1890, and has been retained by all subsequent authors.

In 1870 Philippi⁷ described *F. hispida* from Chile, and in the next decade Griesbach published three radiate species, truly referable to the genus, from Argentina. Philippi's species, however, represented in the Berlin Herbarium by an authentic but very poor specimen, is a *Viguiera* apparently identical with *V. gilliesii* (Hook. & Arn.) Hieron.

In 1891 Philippi⁸ published *Helianthus atacamensis*, referred to *Flourensia* by Reiche⁹ in 1905, and in 1895¹⁰ several new species

¹ Prodr. 5: 592. 1836.

² Gen. Pl. 2: 376. 1873.

³ Proc. Amer. Acad. 19: 7. 1883.

⁴ Bertero's reference of *Helianthus thurifer* to *Diomedea* Cass. (*Borrchia*) surely does not justify the citation of a genus "*Diomedea* Bert. non Cass.", as given in all our systematic works.

⁵ Hist. Pl. 8: 46. 1886.

⁶ In Engl. & Prantl, Pflanzenfam. 4⁵: 237. 1890.

⁷ Anal. Univ. Chile 36: 186. 1870.

⁸ Verz. Antofag. Tarapac. Pfl. 48. 1891.

⁹ Fl. Chil. 4: 94-95. 1905.

¹⁰ Anal. Univ. Chile 90: 36-40. 1895.

of *Helianthus*, of which four were referred as species or varieties to *Flourensia* by Reiche in 1905. Only *H. atacamensis* has been examined by the writer, but from description it is clear that all Philippi's species belong to *Viguiera*, or perhaps in part to true *Helianthus*; certainly none is referable to *Flourensia*.

The genus *Flourensia*, here limited as it was redefined by the writer¹¹ in 1913, includes 23 species, nine Mexican, of which one enters the southwestern United States, the other 14 native in the Andes from central Peru to Chile and the Province of Córdoba in Argentina. All are low, more or less resinous, alternate-leaved shrubs, with few-seriate involucre of herbaceous or only basally indurate phyllaries, thickened or more or less compressed achenes, villous at least on the margin, and persistent or rarely deciduous pappus of two often trifold awns and rarely a few narrow acute squamellae. The present revision, begun at the Berlin Herbarium in the summer of 1914, has been completed by a study of the material in the British Museum, the Kew Herbarium, the Gray Herbarium, and the United States National Herbarium, in the course of which it has been possible to examine types of all the species with the exception of the original *Helianthus thurifer* of Molina, material of which is probably no longer in existence.

SYSTEMATIC TREATMENT.

FLOURENSIA DC.

Flourensia DC. Prodr. 5: 592. 1836.

Resinous shrubs, with alternate, linear-lanceolate to ovate or oval, feather-veined leaves and cymose-panicked or solitary heads; heads small to large, many-flowered, radiate or discoid, the rays neutral or rarely styliferous but sterile, the flowers all yellow; involucre 2 to 4-seriate, graduated or subequal, the phyllaries lanceolate or linear-lanceolate to ovate, herbaceous or subherbaceous throughout, or often subindurate and more or less striate below; receptacle flattish; pales scarious or subscarious, nerved, usually obtusish, keeled, embracing and falling with the achenes; rays usually present, oval to oblong, neutral, or rarely styliferous but sterile; disk corollas with slender tube and cylindric or funnellform throat, the short limb 5-toothed; anthers with ovate terminal appendages and cordate-sagittate bases; style branches usually slender and recurved, with short, obtuse or acutish, dorsally hispidulous appendages; disk achenes somewhat compressed or strongly thickened, often striate, oblong or cuneate to obovate, silky-villous, at least on margin, rarely with narrow crustaceous margin; pappus usually persistent (rarely deciduous or altogether wanting), of two often trifold awns and rarely intermediate squamellae, the latter usually united with the awns and probably representing their decurrent ampliate bases.

Type species, as here selected, *F. laurifolia* DC.

¹¹ Proc. Amer. Acad. 49: 348-349, 350. 1913.

KEY TO SPECIES.

Heads discoid.

Leaves entire.

Leaves ovate to obovate, 2 to 6 cm. wide. 1. *F. laurifolia*.

Leaves 4 to 11.5 mm. wide.

Leaves narrowly lanceolate, 4 to 7.5 mm. wide. 2. *F. retinophylla*.Leaves ovate to oval, 6.5 to 11.5 mm. wide. 3. *F. cernua*.Leaves mucronate-dentate, rhombic-ovate. 4. *F. ilicifolia*.

Heads radiate.

Young branches densely pilose-lanate; heads numerous, in regular cymose panicles. 5. *F. glutinosa*.

Young branches not pilose-lanate; heads solitary to several at tips of branches, not regularly cymose-paniculate.

Petioles mostly 1 to 1.5 cm. long; leaves with the secondary veinlets not prominent-reticulate beneath. 6. *F. collodes*.

Petioles much shorter, or else leaves with the secondary veinlets prominent-reticulate.

Phyllaries 13 to 23 mm. long, with ovate or lanceolate base and elongate linear-attenuate tip. 7. *F. pringlei*.

Phyllaries 4 to 15 mm. long, or if longer without linear-attenuate tip.

Leaves narrowly oblong-elliptic to lanceolate, very glutinous, strictly entire, thick, mainly 5 to 13 cm. long. Heads 1 to 4, axillary and terminal, 3.5 to 5.3 cm. wide, on peduncles 3 to 8 cm. long.

Phyllaries narrowly lanceolate; leaves 3.3 to 6.5 cm. long. 8. *F. resinosa*.Phyllaries (at least the inner) with broad rhombic-obovate base and lanceolate tip; leaves 7.5 to 13 cm. long. 9. *F. heterolepis*.

Leaves usually oval, ovate, or broadly elliptic, rarely lanceolate, not strongly glutinous.

Involucre (at least in youth) densely and usually subcanescently pilose or hispid-pilose.

Leaves densely and finely prominent-reticulate, 1.5 to 2.5 cm. long. 10. *F. microphylla*.Leaves loosely reticulate, 2 to 4.2 cm. long. 11. *F. suffrutescens*.

Involucre green, subglabrous or sparsely pubescent chiefly on the margin of the phyllaries.

Leaves narrowly lanceolate, hispid-hirtous especially on margin, 4.5 to 9.5 mm. wide; branchlets hirtous. 12. *F. hirta*.

Leaves usually ovate, oval, or elliptic, mostly more than 1 cm. wide, not hispid-hirtous; branchlets not hirtous.

Leaves usually entire, when regularly denticulate narrowly oblong-lanceolate to lanceolate.

Leaves mostly ovate or oval or, if narrowly lanceolate, strictly entire.

Leaves entire (except in *F. leptopoda*); involucre 4 to 11 mm. high, the phyllaries not lance-spatulate.

Leaves not rhombic-ovate, entire or rarely with a few irregular teeth; petioles less than one-third as long as blade.

Phyllaries narrow, linear to lanceolate, rarely with slightly dilated ovate-lanceolate bases.

Leaves 1.5 to 5 cm. long, 4 to 18 mm. wide.

Leaves strongly prominent-reticulate. 13. *F. fiebrigii*.

Leaves not prominent-reticulate.

Phyllaries narrowly lanceolate, not widened at base; leaves narrowly oblong or elliptic, 0.4 to 1 cm. wide. 14. *F. polyclada*.

- Phyllaries linear-lanceolate or linear-spatulate from an ovate-lanceolate base; leaves ovate or oblong-ovate, 1.1 to 1.8 cm. wide 15. *F. niederleinii*.
 Leaves 5 to 13 cm. long, usually 2 to 5 cm. wide.
 Heads about 2.5 cm. wide; disk flowers 16 to 23.
 16. *F. campestris*.
 Heads 3.6 to 4 cm. wide; disk flowers 29 to 40.
 17. *F. riparia*.
 Phyllaries broad, ovate or oval.
 Outer or middle phyllaries with ovate base and abruptly narrowed tip..... 18. *F. tortuosa*.
 All the phyllaries broadly ovate to oblong, without abruptly narrowed tip..... 19. *F. oolepis*.
 Leaves rhombic-ovate, deeply repand-dentate; petioles about one-third as long as blade..... 20. *F. leptopoda*.
 Leaves elliptic to ovate or oblong-elliptic, usually coarsely repand-dentate; involucre 1 to 2 cm. high, the phyllaries usually lance-spatulate..... 21. *F. thurifera*.
 Leaves narrowly lanceolate or oblong-lanceolate, usually denticulate, 7 to 13 mm. wide..... 22. *F. angustifolia*.
 Leaves oval or oblong-oval, 2 to 4 cm. wide, regularly denticulate.
 Phyllaries lanceolate to oblong-lanceolate, 7 to 8 mm. long.
 23. *F. macrophylla*.

1. *Flourensia laurifolia* DC. Prodr. 5: 592. 1836.

Helianthus laurifolius Benth. & Hook.; Hook. & Jacks. Ind. Kew. 1²: 1112. 1893, as synonym.

Shrub, 1.5 to 3 meters high, much branched, resinous-viscid, especially on the younger parts, and sparsely hispidulous or puberulous on the peduncles; leaf blades 5.5 to 13 cm. long, 2 to 6 cm. wide, ovate to elliptic-ovate or obovate, acuminate or acute, rarely obtuse, mucronulate, cuneate at base, entire, resinous, shining, strigillose along costa above, otherwise glabrous, finely prominulous-reticulate on both sides (the larger lateral veins about 14 pairs); petioles sparsely strigillose, 5 to 10 mm. long; heads in cymose panicles of 3 to 7 at ends of branches and branchlets, usually overtopped by the leaves; peduncles 1.5 to 2.8 cm. long, axillary, sometimes nodding in fruit; disk in flower turbinate-hemispheric, 1.5 cm. high, 1 to 1.3 cm. wide, in fruit subglobose; involucre 3 to 4-seriate, graduated, 10 to 11 mm. high, the outermost phyllaries linear-lanceolate or lance-ovate, obtuse to acutish, coriaceous-herbaceous, green, about 6 mm. long, ciliate toward tip, the others oblong-ovate to oblong-lanceolate, narrowed above the middle to an obtusish tip, resinous, glabrous or obscurely ciliolate, blackish green with paler margin, subcoriaceous, in old fruit spreading or reflexed; disk corollase cylindric-funnelform, 6.8 mm. long (tube 2 mm.); pales scarious laterally, resinous at the obtusish tip, 12 mm. long; achenes narrowly obovate, somewhat thickened, densely pilose, 7.5 mm. long; awns 2, pilose, often 2 or 3-fid below, about 5 mm. long; squamellae none.

TYPE LOCALITY: Between Victoria ("Vittoria") and Tula, Tamaulipas, Mexico.

ILLUSTRATION: Deless. Icon. Sel. 4: pl. 35.

SPECIMENS EXAMINED:

TAMAULIPAS: Between Victoria and Tula, "cerca las Minces," November, 1830, *Berlandier* 2205 (type collection; B, G, K, Prod.). Mountains between Victoria and Tamaulipas, 1830, *Berlandier* 785 (G). Near Victoria, altitude 320 meters, 1907, *Palmer* 32 (G, N).

SAN LUIS POTOSÍ: Minas de San Rafael, 1911, *Purpus* 4789a (B, G, N). San Luis Potosí to Tampico, 1878-79, *Palmer* 1109 (G, K).

Flourensia laurifolia is readily distinguished by its discoid heads and large, ovate to obovate leaves.

2. *Flourensia retinophylla* Blake in Robinson, Proc. Amer. Acad. 49: 505. 1913.

Much-branched resinous shrub, with brownish gray bark, the branchlets viscid; leaves mostly crowded toward the ends of the branchlets, their blades 2.5 to 3.5 cm. long, 4 to 7.5 mm. broad, narrowly lanceolate, acute to subacuminate at both ends, mucronulate, entire, viscid, reticulate-venulose, with very indistinct primary veins; petioles very narrowly margined, 1 to 2 mm. long; heads in racemose corymbs of 2 to 6 at tips of branchlets, exceeded by the leaves, on 1-headed 1 to 3-bracteolate peduncles 0.4 to 1 cm. long; disk 12 to 15-flowered, turbinate, 10 to 13 mm. high; involucre triseriate, graduated, 8 mm. high, the phyllaries oblong-lanceolate to subovate-lanceolate, obtusish, yellowish green, lineate-striate, glutinous; pales firm, mucronate, obtuse, about 3-nerved, 8.5 to 10 mm. long; disk corollas glutinous, 5 to 5.8 mm. long (the tube 1.1 to 1.5 mm.); achenes cuneate, slightly thickened, densely villous, 6 mm. long; awns 2, serrulate, somewhat ampliate at the base, 3 mm. long; squamellae none.

TYPE LOCALITY: Sierra de la Paila, Coahuila, Mexico.

SPECIMENS EXAMINED:

COAHUILA: Sierra de la Paila, November, 1910, *Purpus* 4728 (type collection; B, G, K, N).

This species, the type collection of which was distributed as *F. laurifolia*, is easily distinguished from that and from the other discoid species by its narrowly lanceolate, very glutinous leaves.

3. *Flourensia cernua* DC. Prodr. 5: 593. 1836.

Helianthus cernuus Benth. & Hook.; Hook. & Jacks. Ind. Kew. 1²: 1112. 1893, as synonym.

Much-branched shrub, 1 to 2 meters high, erect or procumbent with erect branches, the bark gray, the heads and young branches resinous; branches strigillose; leaf blades 1.7 to 2.5 cm. long, 6.5 to 11.5 mm. wide, ovate to oval, acute at both ends, mucronulate, entire, pale green, somewhat resinous, obscurely reticulate-veined, with one or two pairs of the lateral nerves sometimes conspicuous; petioles slightly strigillose, 1 to 2.5 mm. long; heads nodding, solitary in the leaf axils, forming long leafy inflorescences; peduncles short, curved, with 1 to 3 ovate or elliptic bracteoles at apex; disk subturbinate, 12 to 20-flowered, 9 to 11 mm. high; involucre 2 or 3-seriate, subequal, 4.5 to 5 mm. high, the phyllaries oblong-lanceolate, acutish, resinous; disk corollas resinous-dotted, 3.5 mm. long (tube 1 mm.); pales rather thin, scarcely nerved, widened upwardly, then abruptly pointed, yellowish with a blackish keel above, 6 to 6.5 mm. long; achenes narrowly cuneate, thickened, villous, 6 mm. long, 2 mm. wide; awns 2, ciliolate, unequal, 2.5 to 3.2 mm. long; squamellae none.

TYPE LOCALITY: Between Monterey and Lampasos, Nuevo León, Mexico.

SPECIMENS EXAMINED:

TEXAS: Big Springs, 1899, *Bray* 401 (N). El Paso, 1885, *Gray* (G). Prairies east of El Paso, 1849, *Wright* 355 (G, K). Valley of the Pecos, and hills between the Mimbres and the Rio Grande, 1851, *Wright* 1229 (B, G, K). Along the Pecos, 1850, *Thurber* 115 (G). Sierra Blanca, 1913, *Rose & Fitch* 17933 (N). Presidio and foothills of Guadalupe Mountains, 1881, *Havard* 83 (G, N). Valentine, 1904, *Bailey* 917 (N). Chenate region, 1889, *Nealley* 533 (N). Without definite locality, *Mexican Boundary Survey* 563 (N); in 1851, *Wright* 299 (G).

NEW MEXICO: Pecos Valley near Texas line, 1901, *Bailey* 722 (N). Tularosa, 1904, *Gaut* 20 (N). San Andreas Mountains, 1902, *Gaut* 29 (N). Pena Blanca, Organ Mountains, 1906, *Wooton & Standley* (N). Mesa west of Organ Mountains, Dona Ana County, 1903 and 1904, *Wooton* (N). Lake Valley, 1914, *Beals* (N). Hachita, 1908, *Goldman* 1306 (N). Las Palomas, altitude 1,280 meters, 1909, *Goldman* 1792 (N).

ARIZONA: Portal to Paradise, Cochise County, altitude 1,600 to 1,730 meters, 1914, *Eggleston* 10667, 10668 (N). About Portal, 1914, *Eggleston* 10916 (N). Mesas, Bowie Station, October, 1882, *Pringle* (G, N). Near Fort Huachuca, 1894, *Wilcox* 413, 503 (N).

SONORA: Near Monument No. 26, 1892, *Mearns* 1142 (N). San Bernardino Ranch, 1892, *Mearns* 831 (N).

CHIHUAHUA: Hills and plains near Chihuahua, 1885, *Pringle* 292 (B, G, K, N). El Paso to Chihuahua, *Thurber* 788 (G). Candelaria, 1911, *Stearns* 281 (N).

COAHUILA: Parrás, 1880, *Palmer* 740 (G, K); in 1898, *Palmer* 434 (G, N). Saltillo, 1902, *Palmer* 286 (G, N). Pena, 1905, *Purpus* 1011 (G).

NUEVO LEÓN: Monterrey, *Weber* (G). Hills near Doctor Arroyo, 1904, *Pringle* 13053 (G, N). From Monterrey to Lampazos, 1828, *Berlandier* 141 (G), 1401 (type collection; B, G, K, Prod.).

DURANGO: Mapimi, 1898, *Palmer* 434 (K, N).

SAN LUIS POTOSÍ: Foot of mountains, Real de Coutorie (?), 1827, *Berlandier* 1348 (G), 1354 (G, N). Without definite locality, 1878, *Parry & Palmer* 469 (B, G, K).

ZACATECAS: Plains and low ridges, Cedros, 1907, *Lloyd* 16 (N), 30 (G).

MEXICO (Republic of): Without definite locality, *Gregg* 421, 527 (G).

This species, the only one known to occur north of the Mexican border, is easily told by its discoid nodding heads and small ovate or oval leaves. It is sometimes called "varnish bush" or "tar bush" in the Southwest. It has a hoplike odor and a bitter taste. The leaves and heads are commonly sold in the drug markets of northern Mexico, and are taken in the form of a decoction for indigestion. The native name is "hojasé" or "hojasén." Palmer notes that it is also employed as a remedy for female diseases.

4. *Flourensia ilicifolia* T. S. Brandeg. Zoe 5: 238. 1906.

Erect much-branched shrub, with grayish brown bark, the young branchlets slightly pubescent, resin-encrusted; leaves mostly crowded toward the ends of the branchlets, their blades 1.6 to 2.4 cm. long, 1 to 1.7 cm. wide, yellowish green, rhombic-ovate, repand-dentate with 3 to 6 pairs of stiffly mucronate teeth, acute at each end, mucronate, coriaceous, glutinous, obscurely reticulate, the veins not prominulous, the lateral veins about 3 to 6 pairs; petioles flattened, puberulous and resinous, often purplish-tinged, 1.5 to 5 mm. long; heads solitary or 2 or 3 together at tips of branchlets, about 22-flowered, on puberulous, resinous, about 3-bracted peduncles 1 cm. long; disk 1.3 to 1.6 cm. high; involucre 2-seriate, subequal, 6 to 6.5 mm. high, the phyllaries oblong to oblong-ovate, obtuse, coriaceous, yellowish green, resinous and ciliate, not striate; pales broadened below the subtruncate apex, yellowish, with brown or purple-tinged apex, scarious-margined, nearly glabrous, nerved, 9 to 10.5 mm. long; disk flowers 5 or rarely 4-toothed (the teeth oblong, obtusish, 2 to 3 mm. long), 6 to 7 mm. long, the tube 1.5 to 1.8 mm. long, the throat campanulate-funnelform; achenes narrowly cuneate, blackish, silky-villous, with white crustaceous base and very narrow border, 8 to 9.5 mm. long; awns 2, broadly lanceolate, attenuate, villous-ciliate, 2.5 to 4.5 mm. long, separate or united at base by a low crown which usually develops one or two lacerate squamellæ (2 to 3 mm. long) on each side of achene.

TYPE LOCALITY: Sierra de Parrás, Coahuila, Mexico.

SPECIMENS EXAMINED:

COAHUILA: Sierra de Parrás, March, 1905, *Purpus* 1150 (type collection; B, G).

This very distinct species is unique in the genus in its strongly mucronate-dentate, rhombic-ovate, short-petioled leaves.

5. *Flourensia glutinosa* (Robins. & Greenm.) Blake, Proc. Amer. Acad. **49: 374. 1913.**

Encelia glutinosa Robins. & Greenm. Amer. Journ. Sci. III. **50**: 155. 1895.

Shrub, 3 to 5 meters high, the bark gray, furrowed, the young branches more or less pilose-lanate with whitish hairs, the axis and branches of inflorescence resinous, pubescent, striate; leaf blades 6.5 to 9 cm. long, 1.8 to 3.8 cm. wide, ovate to ovate-lanceolate, acuminate, narrowed to the base, entire, mucronate, minutely scabrous above, scabrous-pubescent along the veins beneath, pale green, rather coarsely prominulous-reticulate (the prominent lateral veins 7 to 13 pairs); petioles lanate-pilose or merely pilosulous, 4 to 12 mm. long; heads about 2.5 cm. wide, 6 to 26 in cymose panicles at ends of branches, the 1 to 5-headed peduncles leafy-bracted at base, 2 to 5 cm. long, the bracts of inflorescence oval to ovate, 6 to 12 mm. long; disk very resinous, 1.4 to 1.8 cm. high, 9 to 11.5 mm. wide; involucre 3 or 4-seriate, strongly graduated, 5 to 6.5 mm. high, often calyculate with a few bractlets at apex of peduncle, the phyllaries lanceolate, obtusish, resinous, striate, fuscous, subherbaceous-tipped; rays about 8, golden-yellow, oblong-oval, barely emarginate, glabrous but the tube pilose, 1.5 to 1.7 cm. long, 5 to 7 mm. wide; pales subcoriaceous, enlarged and crested with two scarious wings at apex, resin-encrusted, 11 mm. long; disk flowers yellow, blackish green on the teeth, slenderly funneliform, at apex resinous, 7 to 8 mm. long (tube 1.5 mm.); achenes narrowly cuneate, sometimes quadrangular, silky-pilose, 6.5 to 11 mm. long; awns 2, or rarely 4, rather easily deciduous, 7 mm. long; squamellae none, or sometimes 2 or 3 present between each pair of main awns, and about half as long.

TYPE LOCALITY: Las Hoyas Canyon, Oaxaca, Mexico.

SPECIMENS EXAMINED:

PUEBLA: Limestone hills, near Tehuacán, 1895, *Pringle* 7023 (G).

OAXACA: Las Hoyas Canyon, altitude 1,370 meters, November 2, 1894, *Pringle* 6024 (type collection; B, G, K, N). About 9.6 kilometers above Domin-guillo, altitude 1,370 to 1,675 meters, 1894, *Nelson* 1832 (G. N).

Flourensia glutinosa is readily distinguished by its many-headed cymose panicles and pilose-lanate branches.

6. *Flourensia collodes* (Greenm.) Blake, Proc. Amer. Acad. **49: 373. 1913.**

Encelia collodes Greenm. Proc. Amer. Acad. **39**: 110. 1903.

Slightly resinous shrub; branches striate, angled, rather sparsely sordid-puberulous and resin-dotted; leaf blades 6 to 10 cm. long, 2.2 to 3.8 cm. wide, ovate, long-acuminate, falcate, at base inequilaterally rounded, firm but scarcely coriaceous, entire, puberulous on costa and main veins below, otherwise nearly glabrous, finely reticulate, only the chief veinlets prominulous, the 9 or 10 pairs of lateral veins prominent; petioles puberulous above, slender, 7 to 15 mm. long; heads in cymose panicles of 4 or 5 at ends of branches, terminal and axillary, 4 cm. wide, very resinous, on sparsely sordid-puberulous pedicels 8 cm. long or less, usually bracteate; disk 1.4 to 1.6 cm. high, 1.7 to 2 cm. thick; involucre 3-seriate, graduated, 1 cm. high, the phyllaries lance-ovate, acuminate to a glandular-callous tip, subherbaceous, thickened, striate, with narrow yellowish glandular-erose margin; receptacle flattish; rays about 14, narrowly elliptic, rarely bearing a short included style, 1.5 cm. long, 5 mm. wide; disk corollas 7 mm. long (tube 1 mm.), resinous; pales blunt, subcucullate at the fuscous apex, 12.5 mm. long; immature achenes pilose-ciliate, otherwise practically glabrous, 6 mm. long; awns 2, slender, 6 mm. long; squamellae 2 pairs, free from each other but united to awns at base, linear-lanceolate, attenuate, deeply and irregularly laciniate, 3 mm. long.

TYPE LOCALITY: Between Ocuilapa and Tuxtla, Chiapas, Mexico.

SPECIMENS EXAMINED:

CHIAPAS: Along road from Ocuilapa to Tuxtla, altitude 335 to 915 meters, August 29, 1895, *Nelson* 3071 (type collection; G, N).

The structures described as squamellae in this species are evidently strictly homologous with the lateral lobes of the awns found in many other species, representing the latter in their extreme development. *F. collodes* differs from the other Mexican species in its comparatively large, ovate, obscurely reticulate leaves and few large heads.

7. *Flourensia pringlei* (A. Gray) Blake, Proc. Amer. Acad. 49: 375. 1913.

Helianthella pringlei A. Gray, Proc. Amer. Acad. 21: 389. 1886.

Encelia oblonga Robins. & Fern. Proc. Amer. Acad. 30: 118. 1894.

Stems numerous, suffrutescent, erect from a woody base, 30 to 40 cm. high, nearly simple or much branched, leafy, yellowish green becoming grayish, striate, glabrous; leaf blades 3.2 to 10 cm. long, 1.4 to 4.3 cm. wide, nearly uniform, elliptical-oblong to oblong-lanceolate, from round-tipped to acute, cuneate at base, with narrow crustaceous tuberculate-hispidulous margin, somewhat resinous, often strigillose on margin, otherwise glabrous, venose, the lateral veins 7 to 11 pairs; petioles broad, flat, 1 to 2 mm. long; heads solitary at tips of stems and branches, 2.5 to 4 cm. wide, on striate glabrous peduncles 6 to 13.5 cm. long; disk 1.3 to 1.5 cm. high, 1.5 to 2.5 cm. wide (in fruit 3 cm. wide); involucre 2-seriate, subequal or the outer phyllaries longer and overtopping the disk, often with some similar calyculate bracts at apex of peduncle, 1.3 to 2.3 cm. high, the phyllaries linear-attenuate from a thickened, ovate or lanceolate base, resinous and sparsely ciliolate; rays 14 to 20, golden-yellow, oval or oblong-oval, glabrous, 1 to 1.3 cm. long, 3.5 to 6 mm. wide; disk flowers glabrous, resinous, with short tube and long cylindric throat, 5.5 mm. long (tube 0.8 mm.); pales broadened upwardly, resinous toward the obtuse apex, 11 mm. long; achenes at maturity strongly thickened, densely villous, striate, 11 mm. long, 3.7 mm. wide; awns 2, ciliolate, firm, often somewhat recurved, 5 mm. long, often deciduous at maturity; squamellae none.

TYPE LOCALITY: Rocky hills near Chihuahua City, Chihuahua, Mexico.

SPECIMENS EXAMINED:

CHIHUAHUA: Rocky hills near Chihuahua City, September 7, 1885, *Pringle* 646 (type collection of *H. pringlei*; B, G, K, N). Plains near Casas Grandes, October 10, 1891, *Hartman* 812 (type collection of *E. oblonga*; G, K).

DURANGO: Santiago Papasquiaro, altitude 2,045 meters, 192 kilometers west of north from Durango City, 1896, *Palmer* 425 (B, G, K). El Oro to Guanacevi, 1898, *Nelson* 4730 (N).

Flourensia pringlei, the least shrubby member of the genus, is unique in its numerous low stems, its oblong subsessile leaves, and particularly in its characteristic phyllaries.

8. *Flourensia resinosa* (T. S. Brandeg.) Blake, Proc. Amer. Acad. 49: 375. 1913.

Encelia resinosa T. S. Brandeg. *Zoe* 5: 240. 1906.

Branching shrub, vernicose-resinous, the branches striate, brown, simple or again branched; leaf blades 3.3 to 6.5 cm. long, 1 to 1.8 cm. wide, narrowly oblong-elliptic, lance-elliptic, or lanceolate, acute at each end, mucronate, entire, resinous-punctate, pale green with yellowish costa, densely prominulous-reticulate, with about 18 pairs of weak lateral veins; petioles flattened, 2 to 4 mm. long; heads 1 to 4, terminal and axillary, 3.5 to 5.3 cm. wide, on peduncles 6 to 7 cm. long; disk 1.1 to 1.4 cm. high, 1.3 to 1.7 cm. thick; involucre 3-seriate, 7 to 9 mm. high, scarcely graduated, the phyllaries narrowly lanceolate, acuminate, herbaceous, infusate below, very resinous, slightly ciliolate; rays 10, oblong, golden, 1.3 to 2.2 cm. long, 5.5 to 9 mm. wide; disk corollas glabrous, 5.6 mm. long (tube 1 mm.); pales subacute, resinous at apex, 8.5 mm. long; immature achenes silky, 5 mm. long; awns 2, unequal, slender, at base strongly ampliate and more or less trifid, about 4.5 mm. long; squamellae none.

TYPE LOCALITY: Ixmiquilpan, Hidalgo, Mexico.

SPECIMENS EXAMINED:

HIDALGO: Near Ixmiquilpan, 1831, *Schiede & Deppe* 1564 (Ber., photo. and fragm. G). Ixmiquilpan, *Ehrenberg* 35 (Ber.). Mountains, Ixmiquilpan, August, 1905, *Purpus* 1458 (type collection; G). Ixmiquilpan, 1905, *Rose, Painter & Rose* 9025 (N).

This apparently local species is distinguished from all except *F. heterolepis* by its narrowly oblong-elliptic to lanceolate, very glutinous, entire leaves and few long-peduncled, rather large heads. Ehrenberg's plant in the Berlin Herbarium was labeled by Schultz Bipontinus more than sixty years ago as a new species of *Flourensia*, under a name which has already been used three times for true *Flourensias* originally published under other generic names.

The number of the type collection is given as 1456 in the original description, but Mr. Brandege informs me that the correct number is 1458.

9. *Flourensia heterolepis* Blake, Contr. Gray Herb. n. ser. 54: 186. 1918.

Viguiera (?) *glutinosa* Rusby, Mem. Torrey Club 4: 211. 1895. Not *F. glutinosa* Blake, 1913.

Shrub; stem (or branch) slender, remotely leafy, olivaceous, round-angled, strongly resinous; leaf blades 7.5 to 13 cm. long, 1.4 to 2.5 cm. wide, lanceolate or narrowly elliptic-lanceolate, acuminate or acute at both ends, mucronate, resinous, entire, densely prominulous-reticulate, with about 13 pairs of lateral nerves and yellowish white costa; petioles marginless, 6 to 16 mm. long; heads 3 or 4, terminal and axillary toward ends of branches, about 4.5 cm. wide, on sparsely linear-bracted peduncles 3 to 8 cm. long; disk 1 to 1.2 cm. high, 1.5 to 1.7 cm. wide; involucre 3-seriate, very glutinous, 11 to 12 mm. high, the outer phyllaries somewhat shorter, lanceolate, acuminate to a callous apex, herbaceous, the inner longer, with a rhombic-obovate body (3.5 mm. wide), laterally chartaceous-coriaceous and glandular-fimbriatulate, and an abruptly narrowed lanceolate herbaceous tip; rays about 14, oblong, glutinous, glabrous, 2.2 cm. long, 7 mm. broad; disk corollas 5 mm. long (tube 0.6 mm.); pales scarious-margined and lacerate above, with slightly widened deltoid cuspidulate erose apex, 8 mm. long; achenes (immature) cuneate, densely silky-pilose, 3.5 mm. long; awns 2, 2.7 mm. long; squamellae none.

TYPE LOCALITY: Cochabamba, Bolivia.

SPECIMENS EXAMINED:

BOLIVIA: Cochabamba, 1891, *Bang* 977 (type collection; B, G, N).

This species, curiously similar in general features to the Mexican *F. resinosa*, is readily separated from it by its broad-based inner phyllaries.

10. *Flourensia microphylla* (A. Gray) Blake, Proc. Amer. Acad. 49: 374. 1913.

Encelia microphylla A. Gray, Proc. Amer. Acad. 15: 37. 1879.

Much-branched shrub, about 1 meter high, with grayish brown bark, the young branchlets purplish brown, striate, subcanescently hispid-pilose with incurved hairs; leaf blades 1.5 to 2.5 cm. long, 5 to 10 mm. wide, ovate to elliptic-ovate, acute at both ends, cuspidate, entire but somewhat wavy-margined, more or less scabrous-pubescent, particularly beneath and on margin, somewhat resinous, densely and finely prominulous-reticulate, with about 7 to 9 pairs of obscure lateral veins; petioles pubescent, 1.5 to 4 mm. long; heads solitary at tips of branches, 2.5 to 2.8 cm. wide, on bracteate peduncles 3 to 12 cm. long; disk 11 to 14 mm. high, 12 to 15 mm. thick; involucre 2 or 3-seriate, equal or the inner phyllaries elongate, 10 to 15 mm. high, the phyllaries ovate-lanceolate to narrow-lanceolate, acuminate, herbaceous, rather densely and subcanescently hispid-pilose, more or less glabrate in age; rays about 10, golden-yellow, oval, emarginate at apex, glabrous, 1 cm. long, 4 mm. wide; disk flowers glabrous, 6 mm. long (tube 1 mm.), the throat cylindric or cylindric-funnelform; pales rather thin, narrowed toward the blackish green apex, glandular on the keel, ciliate at apex, 7 to 11 mm. long; achenes oblong-obovate, flattish, densely pilose, subglabrate below,

4 to 5 mm. long; pappus of 2 slender, strigose, easily deciduous awns 3 mm. long, or sometimes wanting.

TYPE LOCALITY: Saltillo, Coahuila, Mexico.

SPECIMENS EXAMINED:

COAHUILA: Saltillo, August, 1878, *Parry & Palmer* 462 (type collection; G, K).

Shady arroyos and hill slopes, Saltillo, 1898, *Palmer* 795 (G, N). Limestone hills, Carneros Pass, 1889, *Pringle* 2392 (B, G, K). Without definite locality, 1878, *Parry* 26 (G); in 1880, *Palmer* 589 (G, K).

Like *Flourensia resinosa*, this apparently local species finds its closest ally in a species of South America, in this case *F. suffrutescens*, from which it differs in its smaller, densely prominulous-reticulate leaves. From all other Mexican species with radiate heads, *F. microphylla* is at once distinguishable by its small leaves and usually subcanescent involucre. The awns of the pappus are often or usually deciduous at maturity, as in *F. pringlei*.

11. *Flourensia suffrutescens* (R. E. Fries) Blake, Proc. Amer. Acad. **49**: 376. 1913.

Encelia suffrutescens R. E. Fries, Nov. Act. Soc. Sci. Upsal. IV. **1**¹: 83. pl. 6, f. 1-3. 1903.

Shrub, 20 to 30 cm. high, with decumbent-ascending branches about 30 cm. long; stem woody, thick, clothed with a grayish bark; branchlets fuscous, terete, rather densely spreading-pilose, the hairs with slightly enlarged glandular-tuberculate bases; leaf blades 2 to 4.2 cm. long, 8 to 12 mm. wide, narrowly elliptic or lanceolate to ovate, acute or subacuminate, mucronulate, at base cuneate to acuminate, entire, rigidly membranaceous, rather densely pilose on both sides with loose hairs slightly glandular-tuberculate at base, above bright green, beneath paler, obscurely triplinerved (the main veins about 4 pairs, obscurely distinguished from the intermediate veins), loosely prominulous-reticulate especially beneath; petioles pilose, 1 to 2.5 mm. long; heads solitary at apex of branches, 3.5 cm. wide; peduncles 7 to 11 cm. long, bearing one or two leaves, rather densely spreading-pilose, the hairs with slightly glandular-tuberculate bases; disk 9 mm. high, 12 mm. thick; involucre 2-seriate, equal, 12 to 13 mm. high, the phyllaries narrowly oblong-lanceolate or lanceolate, acuminate, herbaceous, not striate (at least when young), callous-mucronulate, loosely subcanescent-pilose outside, the hairs with slightly enlarged bases, within glabrous, 1-nerved; rays 12, linear-oblong or linear-elliptic, bidenticulate or often deeply and unequally 2-lobed, gland-dotted but subglabrous on back, 17 mm. long, 4 mm. wide; disk corollas glabrous, 5.2 mm. long (tube 1 mm.); pales gland-dotted and sparsely hispid-pilose at the blackish green, blunt or acutish, mucronulate apex, 9.5 mm. long; achene (very immature) densely silky-pilose, especially above, about 2.5 mm. long, the hairs at apex of achene simulating squamellae; awns 2, sometimes 3-cleft, unequal, slender, 3.5 mm. long or less; squamellae none.

TYPE LOCALITY: Moreno, Province of Jujuy, Argentina.

ILLUSTRATION: Nov. Act. Soc. Sci. Upsal. IV. **1**¹: pl. 6, f. 1-3.

SPECIMENS EXAMINED:

ARGENTINA: Rocky mountain slope, altitude 3,600 meters, Moreno, Province of Jujuy, December 16, 1901, *Fries* 926 (type collection; N).

Unique among South American species in its subcanescently pilose involucre.

12. *Flourensia hirta* Blake, sp. nov.

Divergently branched shrub, the younger branchlets purple-brown, hirtous, resinous-granular, the older gray, glabrate; leaf blades 3.5 to 4.3 cm. long, 4.5 to 9.5 mm. wide, narrowly lanceolate or linear-lanceolate, acuminate at each end, mucronate, entire, strongly prominulous-reticulate, scabrous-hirtous on both sides with ascending tuberculate-based hairs and more densely hirtous-ciliate; petioles scabrous-hirtous, 2 to 3 mm. long; heads 1 to 4 at apex of branches, 2 cm. wide, on

peduncles 1 to 5.5 cm. long, nodding in fruit; disk 9 mm. high, 8 mm. thick; involucre about 2-seriate, 7 mm. high, the phyllaries subequal, few (about 14), the outer linear-lanceolate, the inner ovate-lanceolate, obtuse or acute, slightly resinous-granular and very sparsely ciliate; rays about 8, oblong, 6 to 7 mm. long, 2.5 mm. wide; disk corollas glabrous, 4 mm. long (tube 0.6 mm.); pales obtuse, resinous at apex, 6.5 mm. long; immature achenes silky, 3.5 mm. long; awns 2, slender, unequal, ciliate, about 4 mm. long; squamellae none.

Type in the Berlin Herbarium, collected in the vicinity of Los Corrales, Sierra Famatina, Province Rioja, Argentina, February 7, 1879, by G. Hieronymus and G. Niederlein (no. 635). Photograph and fragments in the Gray Herbarium.

ADDITIONAL SPECIMENS EXAMINED:

ARGENTINA: Between El Jaguel and Los Cortaderos, Cordillera de la Rioja, February 21, 1879, *Hieronymus & Niederlein* 264 (Ber., fragm. G).

Readily separated from all other species of the genus by its hirtous leaves and branches.

13. *Flourensia fiebrigii* Blake, Bot. Jahrb. Engler 54: Beibl. 119: 47. 1916.

Branching shrub, probably erect, the younger branchlets brown, resinous-granulose, loosely puberulous, the older ones gray-brown, glabrate; leaf blades 2.7 to 5 cm. long, 8 to 14 mm. wide, lanceolate or elliptic-lanceolate or slightly obovate, acute to acuminate at each end, mucronate, entire, prominulous-reticulate with 10 to 12 pairs of lateral veins, resinous and especially in youth loosely hispid-pilose; petioles narrowly margined, 1.5 to 6 mm. long; heads 1 to 3 at ends of branches, 3 to 4 cm. wide; peduncles about 1.5 cm. long; disk 8 mm. high, 8 to 10 mm. thick; involucre 2 to 3-seriate, 5 mm. high, scarcely graduated, the phyllaries resinous-granular and more or less loosely pubescent and ciliate, the outer lanceolate or lance-ovate, acute or acutish, the inner oblong-ovate; rays about 10, golden, oblong-oval, 1.2 to 1.6 cm. long, 6 to 7.5 mm. wide; disk corollas glabrous, 4 mm. long (tube 0.7 mm.); pales truncate, mucronate, colorate and resinous at apex, 6 mm. long; immature achenes silky, 3.8 mm. long; awns 2, subequal, slender, ciliate, 2 to 2.2 mm. long, sometimes unequally bifid; squamellae none.

TYPE LOCALITY: Near Paicho, west of Tarija, Bolivia.

SPECIMEN EXAMINED:

BOLIVIA: Slope, summit of pass, altitude 3,200 meters, near Paicho, west of Tarija, February 5, 1904, *Fiebrig* 3050 (type collection; Ber., photo. and fragm. G).

Flourensia fiebrigii is distinguished from other South American species by its narrow entire medium-sized prominulous-reticulate leaves and short involucre.

14. *Flourensia polyclada* Blake, sp. nov.

Low shrub, from a thick woody root, the short ascending or procumbent stems much branched; internodes short; branchlets short, resinous, pilose above, monocephalous; leaf blades 1.5 to 3.8 cm. long, 0.4 to 1 cm. wide, narrowly oblong or elliptic, acute at each end, mucronate, entire, with about 4 pairs of inconspicuous lateral veins, not reticulate, tuberculate-strigose especially on margin, scarcely revolute; petioles obsolete; peduncles terminating branchlets, 1.5 to 4.5 cm. long; heads 2.8 cm. wide; disk 8 to 12 (in fruit 16) mm. high, 10 to 12 (in fruit 20) mm. thick; involucre about 3-seriate, 6 to 8 mm. high, the phyllaries subequal or the inner slightly longer, narrowly lanceolate, subacute, resinous, rather sparsely pilose; rays 10, oblong-oval, 13 mm. long, 4.5 mm. wide; disk corollas somewhat resinous on tube and teeth, 4.5 mm. long (tube 1.1 mm.); pales obtuse, resinous on back, 9.8 mm. long; achenes cuneate-obovate, silky, 8.5 mm. long, 3.7 mm. wide; awns 2, unequal, lacerate, 3 to 4.7 mm. long; squamellae none.

Type in the Berlin Herbarium, collected between La Cueva and La Incrucijada, Sierra Famatina, Province Rioja, Argentina, January 31, 1879, by G. Hieronymus and G. Niederlein (no. 541). Photograph and fragments in the Gray Herbarium.

ADDITIONAL SPECIMEN EXAMINED:

ARGENTINA: La Incrucijada, January 29 to February 3, 1879, *Hieronymus & Niederlein* (Ber.).

From *F. niederleinii*, its only near relative, this species differs in its narrow leaves and narrowly lanceolate phyllaries, these not dilated at base.

15. *Flourensia niederleinii* Blake, sp. nov.

Branching shrub, probably procumbent or ascending, the younger branchlets resinous-granular, sparsely setose-hispidulous, the older ones gray, glabrate; leaf blades 2.3 to 3.5 cm. long, 1.1 to 1.8 cm. wide, ovate to oblong-ovate, acute, mucronate, cuneate or rounded at base, entire, with 7 to 10 pairs of lateral veins, not reticulate, resinous-granular and rather sparsely strigillose on both sides, along costa beneath sparsely hispid-pilose; petioles resinous-granular, more or less hispid, 3 to 8 mm. long; heads 1 to 3 at apex of branches, 2.5 to 3.3 cm. wide, on peduncles 2 to 4 cm. long; disk 8 to 11 mm. high, 1 to 1.3 cm. thick; involucre 2-seriate, 7.5 to 9 mm. high, the phyllaries subequal or the outer frequently longer, linear-lanceolate or linear-spatulate from a short, lance-ovate, blackish green base, resinous-granular and sparsely hispidulous; rays about 8, oblong-oval, 1.2 to 1.6 cm. long, 4.5 to 6.5 mm. wide; disk corollas glabrous, 4 mm. long (tube 0.5 mm.); pales subacute, at apex colorate, resinous, and minutely erose, 6.5 mm. long; achenes cuneate-obovate, silky, 5 mm. long, 2.5 mm. wide; awns 2, ciliolate, at base strongly ampliate and deeply lacerate, unequal, about 3 mm. long; squamellae none.

Type in the Berlin Herbarium, collected at Cuesta Miranda, Sierra Famatina, Province Rioja, Argentina, March 10, 1879, by G. Hieronymus and G. Niederlein (no. 876). Photograph and fragments in the Gray Herbarium.

Flourensia niederleinii is distinguished from *F. polyclada* by its ovate or oblong-ovate leaves, and by its phyllaries, which are linear-lanceolate or linear-spatulate from an ovate-lanceolate base; from *F. campestris* and *F. riparia* by its characteristic phyllaries and its much smaller leaves.

16. *Flourensia campestris* Griseb. Abh. Ges. Wiss. Göttingen 19: 184. 1874.

Helianthus campestris Kuntze, Rev. Gen. Pl. 3²: 157. 1898.

Branching shrub, about 2 meters high; branches resinous-granulose, somewhat hispidulous, the older gray, glabrate; leaf blades 5 to 9 cm. long, 1.3 to 3.4 cm. wide, lanceolate to ovate or oblong-lanceolate, acuminate, mucronate, cuneate to rounded at base, entire or rarely slightly denticulate with appressed teeth, usually resinous-granulose, with about 13 pairs of lateral veins, prominulous-reticulate especially beneath; petioles 3 to 13 mm. long; heads in cymose panicles of 5 to 15 at ends of branches, on terminal and axillary leafy-bracted peduncles; pedicels 0.8 to 2.5 cm. long; heads 2.5 cm. wide; disk 8 to 11 mm. high, 7 to 10 mm. thick; involucre 2-seriate, 4 to 5 mm. high, the phyllaries lance-subulate, subobtuse, loose, resinous-granulose; rays about 8, oval to oblong-oval, 7 to 10 mm. long, 3.3 to 4.3 mm. broad; disk corollas about 16 to 23, resinous on the teeth, 4.5 mm. long (tube 0.9 mm.); pales truncate-mucronulate, resinous at apex, 8 mm. long; achenes blackish, ciliate on the whitish margin, pubescent on the sides, 5 to 6.5 mm. long; awns 2, ciliolate, 3.5 mm. long; squamellae none.

TYPE LOCALITY: Field southeast of Córdoba, Argentina.

SPECIMENS EXAMINED:

ARGENTINA: Abundant in field southeast of Córdoba, 1871, *Lorentz* 245 (type; Ber., fragm. G). Puesto de San José, upper side of the Caleras Sierra near Córdoba, 1876, *Hieronymus* 276 (Ber., N). Sierra Chica de Córdoba, la Falda de la Pumilla, 1876, *Hieronymus* 623 (Ber., N). Between San Roque

and Malagueña, Sierra Chica, January 13, 1871, *Hieronymus* (Ber.). Río Zeballos, Sierra Chica, January 13, 1878, *Galander* (B, Ber.). Córdoba, *Schuyder* (Ber.); September, 1892, *Kuntze* (Ber., N); *Lorentz* 664 (Ber.).

Distinguished from *F. riparia* chiefly by the smaller heads with fewer disk florets (29 to 40 in *F. riparia*). Furthermore, *F. riparia* has looser panicles with longer-peduncled heads.

17. *Flourensia riparia* Griseb. Abh. Ges. Wiss. Göttingen 24: 196. 1879.

Helianthus riparia Kuntze, Rev. Gen. Pl. 3²: 157. 1898.

Branching shrub; branches somewhat resinous, the youngest striate, puberulous; leaf blades 6 to 13 cm. long, 1.5 to 5 cm. wide, oblong-lanceolate to oblong-ovate or elliptic-ovate, acute to acuminate, acute at base, entire, rather thin, minutely puberulous, resinous-granulose, at length subglabrate, somewhat prominulous-reticulate beneath; petioles hirsutulous, 3 to 8 mm. long; heads cymose-paniculate at ends of branches, 3.6 to 4 cm. wide, nodding in fruit; pedicels resinous, puberulous, bracteate, 3 to 5.6 cm. long; disk 1 to 1.2 cm. high, 1.1 to 1.5 cm. wide; involucre 3-seriate, 5 to 6 mm. high, the phyllaries lance-subulate to lance-ovate, loose, resinous, ciliolate, subequal; rays about 10, oblong, 1.4 to 2 cm. long, 3.6 mm. wide; disk corollas 29 to 40, resinous on the teeth, 5 mm. long (tube 0.8 mm.); pales resinous at apex, subtruncate, 7 mm. long; achenes flattish, striate, villous-ciliate, sparsely puberulous above, 6 to 6.5 mm. long, 2.8 to 3 mm. wide; awns 2, ciliate, slightly widened below, unequal, 4 to 4.2 mm. long; squamellae none.

TYPE LOCALITY: Passage of the Río Turamento, Province of Salta, Argentina.

SPECIMENS EXAMINED:

ARGENTINA: Passage of the Río Turamento, Province of Salta, February, 1873, *Hieronymus* & *Lorentz* 268 (type; Ber., N, photo. and fragm. G). Sierra between El Rincón and Clavisan, fluvial district of the Río del Tala, Province of Salta, 1873, *Lorentz* & *Hieronymus* (Ber.).

This species is very closely related to *F. campestris*, but may be distinguished by its larger heads and more numerous disk florets.

18. *Flourensia tortuosa* Griseb. Abh. Ges. Wiss. Göttingen 19: 184. 1874.

Branching shrub, about 2 meters high; younger branches more or less flexuous, resinous-granulose, more or less pubescent, 1 to 3-capitate; leaf blades 3.2 to 10.5 cm. long, 1.3 to 3 cm. wide, lanceolate to ovate-lanceolate, ovate, or oval, acute to acuminate or obtuse, sharply mucronate, cuneate or rounded at base, entire, prominulous-reticulate (lateral veins 5 to 11 pairs), sparsely resinous-granulose, slightly puberulent especially when young, narrowed into scarcely margined petioles 2.5 to 15 mm. long; peduncles 1 to 3.8 cm. long; heads 6 to 7 cm. broad; disk 10 to (fruit) 15 mm. high, 11 to 18 mm. wide; involucre 3-seriate, 7 to 11 mm. high, the phyllaries variable, equal or unequal, broadly ovate to oblong, at least the outer with gradually or abruptly narrowed lanceolate tips, the inner acute or rarely obtusish, all striate, resinous-granular, ciliolate, the inner thinner, erose-ciliate; rays 10, broadly oblong, minutely emarginate to deeply bilobed, 1.8 to 3 cm. long, 7 to 10 mm. broad; disk corollas glabrous, 4.2 mm. long (tube 0.7 mm.); pales ampliate and resinous above, truncate and erose-ciliolate at apex, 1 cm. long; achenes (immature) silky-villous, 6 mm. long; awns 2, unequal, slender, sometimes unequally bifid, up to 3.5 mm. long; squamellae none.

TYPE LOCALITY: Between Belén and Yacutula, Province Catamarca, Argentina.

SPECIMENS EXAMINED:

ARGENTINA: Fields between Belén and Yacutula, *Lorentz* 479 (type collection; Ber., fragm. G). Yacutula, 1878, *Schickendantz* 166 (Ber., photo. G); in 1879, *Schickendantz* 4 (Ber., fragm. G). Quebrada de Villavil, 1876, *Schickendantz* 166 (Ber.). Catamarca, 1896, *Bettfreund* 1125 (Ber.). Department of Andalgalá, 1916, *Jørgensen* 1273 (G).

This species and the next are distinguished by their broadly ovate or oval phyllaries. In the present plant these are provided with abruptly narrowed tips which are wanting in *F. oolepis*.

19. *Flourensia oolepis* Blake, sp. nov.

Branching shrub; branchlets densely resinous-granular, 1 or 2-headed; leaf blades 5.5 to 8.5 cm. long, 2 to 3.2 cm. wide, elliptic-lanceolate or elliptic, acuminate at each end, entire or with a few acute teeth above, reticulate-venulose with about 12 pairs of lateral veins, resinous-granular and minutely puberulous with several-celled hairs chiefly along veins and veinlets; petioles about 1 cm. long, marginate above, resinous; peduncles resinous, minutely puberulous at apex, 4 to 6 cm. long; heads 3 to 3.5 cm. wide; disk 1 to 1.2 cm. high, 1.7 to 2.1 cm. thick; involucre 4-seriate, 7 to 8 mm. high, graduated, the outer phyllaries broadly ovate (5 to 5.5 mm. long, 2.5 to 4 mm. wide), the inner gradually more oblong, all more or less striate, acutish, mucronate, densely resinous-granular, ciliolate; rays 12 to 16, linear-oblong, 12 mm. long, 2.5 mm. wide; disk corollas sparsely resinous, 4.5 mm. long (tube 1 mm.); pales widened above, subtruncate and resinous at apex, strongly striatulate, 7 mm. long; achenes obovate, silky except toward margin, 5.5 to 6.5 mm. long; awns 2, strongly ampliate and deeply lacerate at base, 4 mm. long; true squamellae none.

Type in the Berlin Herbarium, collected at Cuesta de la Oyada, Sierra Achala de Córdoba, Argentina, March 22, 1876, by G. Hieronymus. Photograph and fragments in the Gray Herbarium.

ADDITIONAL SPECIMEN EXAMINED:

ARGENTINA: Foot of the Cuesta de la Chacras, near Devisaderos, Tanninga, etc., west side of the Sierra de Córdoba, February 14, 1876, *Hieronymus* (Ber.).

Flourensia oolepis is distinguished from its only near relative, *F. tortuosa*, by the acutish, not abruptly narrow-tipped, phyllaries.

20. *Flourensia leptopoda* Blake, sp. nov.

Branching shrub; younger branchlets purplish, resinous-granulose, the older ones brown; leaf blades 3 to 4.5 cm. long, 1.3 to 2.5 cm. wide, rhombic-ovate, acuminate, mucronate, cuneate at base, deeply and irregularly repand-dentate with 4 to 6 pairs of cuspidate teeth, lucid, reticulate-venose with about 10 pairs of lateral veins, glabrous or beneath resinous-granular and very slightly hispidulous; petioles slender, 8 to 12 mm. long; heads 1.5 cm. wide, racemose-paniculate on 1 to 3-headed terminal and axillary peduncles; disk 8 mm. high, 8 mm. thick; involucre 2-seriate, 4 to 5 mm. high, the phyllaries equal, lanceolate or lance-subulate, subobtusate, resinous-granular and very sparsely strigillose; rays oval, tridenticulate, 7 mm. long, 4.5 mm. wide; disk corollas glabrous, 4.5 mm. long (tube 1.2 mm.); pales resinous, obtuse, 5.5 mm. long; immature achenes silky, 3.5 mm. long; awns 2, ciliate, slightly flattened, 3 mm. long; squamellae none.

Type in the Berlin Herbarium, collected at Farrecillas (?), Province Rioja, Argentina, March 5, 1906, by J. S. Urriche. Photograph and fragments in the Gray Herbarium.

Readily distinguished by its deeply dentate rhombic-ovate leaves on long slender petioles. Like others of the same genus, this species bears the vernacular name "maravilla."

21. *Flourensia thurifera* (Molina) DC. Prodr. 5: 592. 1836.

Helianthus thurifer Molina, Sagg. Stor. Nat. Chil. 160. 1782.

Helianthus glutinosus Hook. & Arn. Bot. Beechey Voy. 32. 1830.

Tithonia glutinosa Collie; Hook. & Arn. Bot. Beechey Voy. 32. 1830, as synonym.

Diomedea thurifera Bertero; Colla, Mem. Accad. Sci. Torino 38: 37. pl. 31. 1835.

Flourensia besseriana Meyen & Walp. Nov. Act. Acad. Caes. Leop. Carol. 19: Suppl. 1: 270. 1843.

Flourensia thurifera γ *lanceolata* Remy; Gay, Fl. Chil. 4: 288. 1849.

Helianthus besseriana Benth. & Hook.; Hook. & Jacks. Ind. Kew. 1²: 1112. 1893, as synonym.

Erect resinous shrub, 2 meters high, the branches striate, greenish brown or yellowish brown, the young branchlets purplish brown, sparsely pubescent; leaf blades 5.5 to 10 cm. long, 1.5 to 3.5 cm. wide, elliptic or ovate to oblong-elliptic, subacuminate to obtuse at apex, mucronate, cuneate at base, shallowly repand-dentate with 4 to 7 pairs of coarse depressed-triangular mucronate teeth or rarely subentire, thickish, resinous, with a few loose hairs on midvein beneath, prominulous-reticulate with 7 to 12 pairs of conspicuous lateral veins; petioles 2 to 5 mm. long; upper leaves reduced and often entire; heads 3.5 to 7 cm. wide, 2 to 6 at ends of branches on naked or linear-bracted, terminal and axillary, 1-headed peduncles 3 to 13 cm. long; disk 10 to 14 mm. high, 1.4 to (fruit) 2.5 cm. wide; involucre 2 or 3-seriate, subequal or with the outer phyllaries shorter, 1 to 2 cm. high, the phyllaries oblong-lanceolate or lanceolate to oblong-spatulate, acute, loose, herbaceous, thickish, slightly ciliate; rays about 12, oval to oval-oblong, golden-yellow, barely emarginate, glabrous, 1.4 to 2.6 cm. long, 5 to 10 mm. wide; disk corollas 5.5 mm. long (tube 1 mm.), the throat slender-funnel-form; pales widened upwardly, scarious-margined, obtuse, often mucronate, blackish green at apex, 9 to 10 mm. long; achenes oblong-obovate, thickened, villous, 6.5 to 7.5 mm. long, 3 to 3.6 mm. wide; awns 2, stoutish, ciliate, somewhat flattened, 3 to 3.5 mm. long, one or both often split nearly or quite to base, forming 1 or 2 lateral squamelloid awns.

TYPE LOCALITY: Vicinity of Valparaiso, Chile.

ILLUSTRATION: Mem. Accad. Sci. Torino 38: pl. 31.

SPECIMENS EXAMINED:

CHILE: Coquimbo, *Gaudichaud* 84 (G). Valparaiso or vicinity, 1825, *Macrae* (K); in 1830, *Bertero* 954 (B); in 1830, *Bridges* (B, G, K); in 1831, *Cuming* 631 (B, K); in 1832, *Bridges* 234 (B, K); in 1856, *Harvey* (G, K); in 1882, *Philippi & Borchers* (B); in 1914, *Rose* 19113 (N); *Gaudichaud* 153 (G); *Wilkes Exploring Expedition* (G, N); *Moseley* (B); *Reed* (B). Santiago, 1855, *Germain* (B, K); *Philippi* 592 (B), 560 (Ber.). San Cristóbal, near Santiago, 1900, *Hastings* 137 (N). Las Esmeraldas, Department Melipilla, October, 1867, *Reed* (K). Common on hills about Llaillai, 1904, *Scott Elliot* 357 (B). Commonest shrub of foothills, Los Andes, 1904, *Scott Elliot* 415 (B). Without definite locality, *Besser* (type of *F. besseriana*; Ber., photo. and fragm. G); *Cruikshanks* 155 (K); *Gay* (G, K).

Flourensia thurifera, the commonest South American species in herbaria, is usually readily recognized by its large, elliptic to oblong-elliptic, coarsely but shallowly dentate leaves and large involucre of oblong-lanceolate to oblong-spatulate phyllaries. Although Molina's original account ¹² of the species is very short, and his description of the leaves decidedly unsatisfactory, his general account of the plant and its habitat is sufficient to justify the retention of the name in the sense in which it has been used by all subsequent authors. The species bears the vernacular name "maravilla," like others of the genus, and its resin is used for incense in the churches.

22. *Flourensia angustifolia* (DC.) Blake.

Flourensia thurifera β *angustifolia* DC. Prodr. 5: 592. 1836.

Glutinous branching shrub, 0.5 meter high; younger branches and peduncles somewhat sordid-puberulous; leaf blades 3.5 to 7.2 cm. long, 7 to 13 mm. wide, narrowly

¹² "Nelle colline adjacenti al porto de Valparaiso si trova una specie di Girasole *Helianthus thurifer*(*) di consistenza legnosa, dal quale scola ancora una sostanza resinosa, che simiglia per la forma, e per l'odora al vero incenso." (Molina, loc. cit. in text.) "(*)*Helianthus caule fruticoso, foliis lineari-lanceolatis*." (Footnote, loc. cit.)

oblong-lanceolate or lanceolate, acute to acuminate at both ends, slightly repand-denticulate or subentire, resinous-granulose, reticulate, the 15 to 22 pairs of lateral veins scarcely prominulous; petioles margined, 2 to 3 mm. long; heads 3 to 6 at ends of branches, 3 to 4 cm. broad; peduncles axillary and terminal, 1.5 to 6.5 cm. long; disk 8 to 10 mm. high, 8 to 15 mm. thick; involucre 2 or 3-seriate, 6 to 8.5 mm. high, the phyllaries linear-lanceolate (0.8 to 1 mm. wide), subequal, subacute, gradually narrowed from base to apex, resinous-granulose, sparsely ciliate; rays 8, oblong, 1.2 to 1.9 cm. long, 4 to 7 mm. broad; disk corollas somewhat resinous-granulose, 4.5 to 5 mm. long (tube 1 to 1.2 mm.); pales obtuse, resinous-granulose, 8 mm. long; achenes scarcely thickened at maturity, densely silky-villous, 8 mm. long; awns 2, slender, subequal, 4 mm. long; squamellae none.

TYPE LOCALITY: Tarma, Peru.

SPECIMENS EXAMINED:

PERU: Tarma, *Dombey* 24 (cotype collection; Ber., photo. G., Prod.). Abundant, dry slopes, Tarma, Department of Junin, altitude 3,000 to 3,500 meters, 1903, *Weberbauer* 2385 (Ber., fragm. G).

Dombey's plant is labeled "Chile" in the Prodrusus Herbarium, but a specimen from *Dombey* in the Berlin Herbarium, presumably of the type collection of DeCandolle's variety, is marked as from Tarma, whence also comes *Weberbauer* 2385, the only other collection of this species examined. *Flourensia angustifolia* is distinguished from *F. thurifera* by its narrowly oblong-lanceolate or lanceolate, denticulate or subentire leaves and shorter involucre of linear-lanceolate phyllaries.

23. *Flourensia macrophylla* Blake, Bot. Jahrb. Engler 54: Beibl. 119: 47. 1916.

Branching shrub, the younger branchlets resinous, slightly puberulous; leaf blades 5 to 8.3 cm. long, 2 to 4 cm. wide, oval or oblong-oval, acute or subobtuse, mucronate, broadly cuneate at base, shallowly cuspidate-denticulate above the entire lower third with 11 to 17 pairs of teeth, strongly prominulous-reticulate with 12 to 16 pairs of lateral veins, shining, resinous-granular; petioles narrowly margined, 1.5 to 3 mm. long; heads 2 cm. wide, in cymose panicles of 1 to 3, at apex of terminal and axillary peduncles 3 to 5.5 cm. long; disk 7 to 7.5 mm. high, 8 to 11 mm. thick; involucre 3-seriate, 7 to 8 mm. high, the phyllaries subequal, lanceolate or oblong-lanceolate, not widened above, subacute, resinous-granular and very sparsely ciliate, the outer loose; rays about 8, oval, 8 mm. long, 3.5 mm. wide; disk corollas resinous on teeth, 3.5 mm. long, the tube 0.8 mm. long, gradually widened into the throat; pales colorate and resinous at apex, scarcely mucronate, 6.5 mm. long; immature achenes silky, 3.5 mm. long; awns 2, slender, ciliate, 2.2 mm. long; squamellae none.

TYPE LOCALITY: Between Matucana and Tambo de Viso, Peru.

SPECIMENS EXAMINED:

PERU: Stony places, altitude 2,370 to 2,650 meters, along Lima-Oroya Railroad, between Matucana and Tambo de Viso, December 26, 1901, *Weberbauer* 119 (type, Ber., photo. and fragm. G).

This species may be separated from *F. thurifera* and *F. angustifolia* by its oval or oblong-oval, regularly denticulate leaves, small heads, and small rays.

EXCLUDED SPECIES.

FLOURENSIA ATACAMENSIS (Phil.) Reiche, Anal. Univ. Chile 112: 146. 1903.

Helianthus atacamensis Phil. Anal. Mus. Nac. Chile Bot. 1891: 48. 1891.

This species, of which I have examined authentic material in the Berlin Herbarium, is identical with *Viguiera pazensis* Rusby.¹³

FLOURENSIA CORYMBOSA DC. Prodr. 5: 592. 1836.

This species is properly known as *Viguiera revoluta* (Meyen) Blake.¹⁴

¹³ See Blake, Contr. Gray Herb. n. ser. 54: 142. 1918.

¹⁴ Contr. Gray Herb. n. ser. 54: 121. 1918.

FLOURENSIA CORYMBOSA ARAUCANA (Phil.) Reiche, Anal. Univ. Chile 112: 145. 1903.

Helianthus araucanus Phil. Anal. Univ. Chile 90: 39. 1895.

Identical with *Viguiera revoluta* (Meyen) Blake.

FLOURENSIA CORYMBOSA LANCEOLATA (Meyen) Reiche, Anal. Univ. Chile 112: 144. 1903.

Helianthus lanceolatus Meyen, Reise um die Erde 1: 311. 1834.

A synonym of *Viguiera revoluta* (Meyen) Blake.

FLOURENSIA GAYANA (Phil.) Reiche, Anal. Univ. Chile 112: 145. 1903.

Helianthus gayanus Phil. Anal. Univ. Chile 90: 39. 1895.

Apparently this plant is identical with *Viguiera revoluta* (Meyen) Blake, in which the phyllaries are sometimes appressed as here described by Philippi.

FLOURENSIA HISPIDA Phil. Anal. Univ. Chile 36: 186. 1870.

Identical with *Viguiera gilliesii* (Hook. & Arn.) Hieron.¹⁵

FLOURENSIA NAVARRI (Phil.) Reiche, Anal. Univ. Chile 112: 145. 1903.

Helianthus (Flourensia) navarri Phil. Anal. Univ. Chile 90: 37. 1895.

From Philippi's and Reiche's descriptions this is probably a *Wedelia*, but no specimen has been seen by the writer and the status of the species is uncertain. It can not be a *Flourensia* in any case.

¹⁵ See Blake, Contr. Gray Herb. n. ser. 54: 120. 1918.

REVISION OF THE GENUS OYEDAEA.

By S. F. BLAKE.

INTRODUCTION.

In 1836 De Candolle¹ proposed the genus *Oyedaea*, named for the early Spanish navigator Alphonso Oyeda, and based on the two new species *O. verbesinoides* and *O. buphthalmoides*, the first of which was figured soon afterward in Delessert's *Icones*. In 1848 Gardner² published *O. angustifolia* from Brazil, and described under *Viguiera* two species which were later referred to *Oyedaea* by Bentham and Hooker. He also described³ the genus *Serpaea* with two species, one of which, *S. oblonga*, wrongly referred to *Viguiera* by Bentham and Hooker, was placed in *Aspilia* by Baker in 1884, while the other, *S. ovata*, which must be considered the type of his genus, was referred with three new species to *Oyedaea* by Baker, under the subgeneric name *Serpaea*. In 1858 two new species were published from Colombia by Triana,⁴ *O. cuerviana* (*Triana* 1520, specimen no. 4), and *O. helianthoides* (*Triana* 1520, specimen no. 5). The types of these species I have not been able to examine, but from description the former seems correctly referred to this genus. *O. helianthoides*, however, with a pappus of numerous caducous awns, must belong to *Perymenium* or more probably to *Steiractinia*. It is said by Triana to be identical with *Helianthus scaber* of the Willdenow Herbarium.

In the *Genera Plantarum* of Bentham and Hooker⁵ the genus *Oyedaea*, distinguished from *Zexmenia* solely by its neutral rays, was divided into the three sections, *Wedelioides*, *Serpaea* (Gardn.), and *Verbesinoides*, and the number of species was estimated at 22. Hoffman⁶ in 1890 gave the number of species as 15. The present writer,⁷ when revising the genus *Dimerostemma* Cass. (*Serpaea* Gardn.) in 1917, estimated the number of species of *Oyedaea* at about 20, but subsequent study has reduced this to 13.

¹ Prodr. 5: 576. 1836.

² Lond. Journ. Bot. 7: 293, 398-399. 1848.

³ Lond. Journ. Bot. 7: 296. 1848.

⁴ Ann. Sci. Nat. IV. 9:39. 1858.

⁵ Gen. Pl. 2: 374. 1873.

⁶ In Engl. & Prantl, Pflanzenfam. 4⁵: 238. 1890.

⁷ Contr. Gray Herb. n. ser. 52: 8. 1917.

The genus *Oyedaea* is closely related to *Zexmenia*, *Dimerostemma*, and *Aspilia*. From *Zexmenia* it is readily if somewhat artificially distinguished by its neutral rays. From *Dimerostemma* it differs in its round-sided achenes (four-angled and four-winged only in *O. humboldtiana*), in its lack of a secondary external foliaceous involucre, and in its pappus. The pappus of *Dimerostemma* is composed of two awns only, without intermediate corona, although the lateral angles of the achenes are sometimes produced into short teeth or rarely into awns nearly or quite as long as those of the main angles. In a single species of *Dimerostemma* (*D. asperatum*) the awns are connected at base by their lacerate decurrent bases, but there is no true corona, constricted at base, such as is found in *Oyedaea*. The genus *Aspilia* is distinguished from *Oyedaea* by the fact that its achenes are not winged, although in some species there is a corneous auriculiform appendage on each of the upper angles of the achene. *Oyedaea angustifolia* and *O. bonplandiana*, possessing these appendages but lacking the continuous wing of *Oyedaea*, are here placed in *Aspilia*.

SYSTEMATIC TREATMENT.

OYEDAEA DC.

Oyedaea DC. Prodr. 5: 576. 1836.

Shrubs or herbaceous perennials, with opposite, entire to serrulate leaves and medium-sized yellow heads; heads heterogamous, radiate, the ray flowers 1-seriate, ligulate, neutral, those of the disk numerous, tubular, fertile; involucre 2 to 5-seriate, graduated, subequal, or with the outer phyllaries longer, the phyllaries lanceolate to oval or oblong, indurate at base or essentially throughout, usually with herbaceous tips, or the outer sometimes foliaceous; receptacle flattish or slightly convex; pales firm, concave, persistent; rays oval to linear-oblong, neutral; disk corollas with slender tube, cylindric or cylindric-funnelform throat, and 5-toothed limb; anthers sagittate at base, with ovate terminal appendages; style branches slender, dorsally hispid or hispidulous above, with short, lanceolate, hispid or hispidulous sterile appendages; disk achenes somewhat thickened but distinctly compressed, oblong or rarely cuneate-obovate, 2-winged (in one species 4-angled and 4-winged), the wings narrow or sometimes rather broad, usually united above to the awns or corona; pappus of 2 slender persistent awns and a corona of about 6 to 12 narrow, fimbriate or lacerate, more or less united squamellae.

Type species, as here selected, *Oyedaea verbesinoides* DC.

KEY TO SPECIES.

Phyllaries oval or oblong to lanceolate, with indurate base and herbaceous, loose or reflexed tip.

Plants frutescent.

Phyllaries oval or broadly obovate, with indurate base and herbaceous, usually rounded apex, the innermost in fruit somewhat elongate and with membranous-chartaceous rounded apex.....1. *O. bupthalmoides*.

Phyllaries ovate or oblong to lanceolate, rarely obovate-lanceolate, acute to acuminate or rarely obtuse, the inner not elongate and membranous-chartaceous at apex.

Involucre 4 to 9.5 mm. high, the phyllaries with indurate base and shorter, usually deltoid, mostly reflexed apex.

Leaves feather-veined or sometimes obscurely triplinerved.

Outer phyllaries linear-lanceolate; leaves lanceolate or ovate-lanceolate, obscurely reticulate beneath 2. *O. scaberrima*.

Outer phyllaries ovate-lanceolate to ovate; leaves strongly reticulate beneath.

Leaves rather densely hispid-pilose or pilosulous between the veins on lower surface.

Leaves hispid-pilose beneath; involucre 5.5 to 8 mm. high, the phyllaries acute, scarcely reflexed.

Leaves oblong-ovate to ovate, obscurely serrulate, rounded at base.

3. *O. wedelioides*.

Leaves lance-ovate, distinctly serrulate, cuneate at base.

4. *O. reticulata*.

Leaves hispidulous-pilosulous beneath; involucre 4 to 5 mm. high, the phyllaries acutish or obtusish, with strongly reflexed tips.

5. *O. rusbyi*.

Leaves hispidulous beneath, lanceolate or ovate-lanceolate. Involucre, 4.8 to 6 mm. high, the phyllaries mostly with obtuse reflexed tips.

6. *O. lanceolata*.

Leaves distinctly triplinerved 7. *O. boliviana*.

Involucre 11 to 16 mm. high, the phyllaries with short indurate base and longer, lanceolate to ovate, loose, herbaceous tip 8. *O. verbesinoides*.

Plants herbaceous.

Leaves linear 9. *O. bahiensis*.

Leaves oblong to ovate.

Head solitary; leaves 1.5 to 3.5 cm. long 10. *O. humboldtiana*.

Heads several; leaves 7.5 to 9 cm. long 11. *O. trachyphylla*.

Phyllaries ovate to oval, indurate, without distinct herbaceous tips 12. *O. ovalifolia*.

1. *Oyedaea bupthalmoides* DC. Prodr. 5: 577. 1836.

Shrub; stem terete, brown, striate, densely hispid-pilose with loose curly hairs with scarcely enlarged bases, subcanescent above; branches erect, 3 to 18-headed at apex; leaf blades 7.5 to 13 cm. long, 2 to 5.3 cm. wide, ovate or ovate-lanceolate, acuminate, cuneate at base, crenate-serrate with 17 to 27 pairs of mucronate teeth, triplinerved 1 to 3 cm. above the base, above dark green, pubescent with incurved, rather soft, long and short hairs with scarcely enlarged bases, or tuberculate-hispid with short incurved hairs, beneath densely grayish-tomentulose or pilosulous, the veins brownish; petioles rather softly hispid-pilose, 1 to 1.3 cm. long; pedicels 2.4 to 7 cm. long, canescently hispid-pilose; heads 2.9 to 3.8 cm. wide; disk 8 to 10 mm. high, 11 to 16 mm. wide; involucre 3 to 4-seriate, graduated, 9 to 11 mm. high; outermost phyllaries 3 or 4, oblong to oval-oblong or obovate-oval, acutish to obtuse, herbaceous, in age strongly indurate and subcoriaceous below, spreading at apex, rather softly hispid-pilose with ascending hairs, and ciliate (6.5 to 7.5 by 2 to 3.5 mm.); the next series about 4, oval-oblong or obovate-oval, with somewhat indurate base and narrow scarious margin, herbaceous above, obtusish; the innermost in fruit somewhat elongate, exceeding disk, membranous-chartaceous above, strigillose or subglabrate on back, pilose-ciliate, 4.3 to 6 mm. wide toward the rounded, slightly broadened tip; rays 8 or more (?), oblong, 1.1 to 1.9 cm. long, 3 to 5.5 mm. wide; disk corollas glabrous except on teeth, 6 to 6.5 mm. long (tube 2 to 2.5 mm.); pales narrow, acute, appressed-denticulate toward apex, about 1 cm. long; achenes blackish or mottled, oblong, winged, sparsely appressed-pubescent, 4.5 to 6.5 mm. long, 1 to 2 mm. wide; awns 2, spinulose-ciliolate, unequal, 2.5 to 4.5 mm. long; squamellae

about 6 to 8, acuminate, ciliate, 0.4 to 1.3 mm. long, united at base into a cup adnate to the awns, and to the narrow prolongation of the wings.

TYPE LOCALITY: Peru. Types collected by Poeppig (nos. 22 and 1624).

SPECIMENS EXAMINED:

PERU: Poeppig 1624 (cotype collection; B). Chachapoyas, Mathews 1382 (K), 3058 (B, G, K). Without definite locality, Mathews 1735 (K).

Readily distinguishable by its leaves, which are grayish-tomentulose or densely pilosulous beneath, and by its broad, mostly rounded phyllaries, the inner with submembranaceous tips.

2. *Oyedaea scaberrima* (Benth.) Blake.

Lipochaete scaberrima Benth.; Hook. Journ. Bot. 2: 43. 1840.

Zexmenia scaberrima Benth. & Hook.; Hook. & Jacks. Ind. Kew. 2²: 1250. 1895.

Shrubby, the branches apparently drooping; stem ashy brown, slender, in youth densely tuberculate-hispidulous with ascending hairs, in age subglabrate but densely brownish-tuberculate; leaf blades 6 to 7.5 cm. long, 1.6 to 2.5 cm. wide, lanceolate or lance-ovate, acuminate, cuneate at base, obscurely serrulate with 8 to 10 pairs of appressed mucronate teeth, dull green above, tuberculate-strigillose, lepidote in age, beneath slightly paler, rather sparsely tuberculate-hispidulous, pinnate-veined (veins 6 to 9 pairs), finely and obscurely reticulate; petioles densely tuberculate-hispidulous, unmarginated, 4 to 6 mm. long; heads about 6 in a terminal narrow panicle, about 2.5 cm. wide, on densely tuberculate-hispidulous pedicels 1.1 to 1.4 cm. long; disk 9 to 10 mm. high, 1.2 cm. wide; involucre 4-seriate, somewhat graduated, 7 to 8 mm. high; outermost phyllaries linear-lanceolate, strongly indurate at base, rather densely hispidulous-strigillose, the herbaceous apex loose, mucronate; the next series similar but ovate-lanceolate, acuminate, with broad indurate base and narrow herbaceous apex; the next similar but merely acute, the innermost oblong and obtuse, with scarcely herbaceous tip; rays pale yellow, narrowly oblong, sparsely puberulous and gland-dotted on veins of back, 1 cm. long, 3.5 mm. wide; disk corollas sparsely hispidulous on teeth; pales narrow, barely keeled, acute, minutely strigillose toward apex, 8 mm. long; achene blackish, oblong, strongly compressed, narrowly winged on each side, 5 mm. long, 1.8 mm. wide; awns 2, unequal, slender, minutely ciliate, 3 to 4 mm. long; squamellae about 8 to 10, fimbriate, united below into a cup nearly 1 mm. high.

TYPE LOCALITY: Mount Roraima, British Guiana.

SPECIMEN EXAMINED:

BRITISH GUIANA: Mount Roraima, 1839, Schomburgk (type; K, fragm. G).

Although included in *Zexmenia* by W. W. Jones⁸ in his revision of that genus, this species has neutral rays and is a true *Oyedaea*. It is distinguished from related species by the narrow leaves and phyllaries.

3. *Oyedaea wedelioides* (Klatt) Blake.

Zexmenia wedelioides Klatt, Abh. Naturf. Ges. Halle 15: 328. 1881.

Shrub about 3 meters high; stem dull brown, subterete, tuberculate-strigose, glabrate but persistently tuberculate below, the inflorescence densely strigillose-hispidulous or shortly hispid-pilose with erect hairs; leaf blades 4.2 to 12.5 cm. long, 2.2 to 5 cm. wide, ovate or oblong-ovate to oval-ovate, acute or acuminate, at base broadly rounded, obscurely serrulate with 15 to 18 pairs of appressed mucronate teeth, above dark green, impressed-nerved, tuberculate-strigose and strigillose, beneath scarcely paler, rather densely hispid-pilose with spreading hairs longer along the veins, sparsely gland-dotted, penninerved with 9 to 12 pairs of lateral veins and strongly prominulous-reticulate; petioles densely hispid-pilose, 4 to 15 mm. long; heads 1.7 to 3 cm. wide, ternately arranged in cymose panicles of 5 to 21 at ends of

⁸ Proc. Amer. Acad. 41: 146. 1905.

stem and axillary flowering branches, the ultimate bracts of inflorescence lanceolate, with indurate base and herbaceous tip, 3 to 6 mm. long; pedicels densely hispidulous-pilosulous, 7 to 25 mm. long; disk 9 to 14 mm. high, 6 to 13 mm. thick; involucre 4-seriate, graduated, 5.5 to 8 mm. high, the one or two outermost series of phyllaries ovate-lanceolate, acuminate, narrowed nearly from base to apex, the inner acute, ovate-oblong to oblong, all with strongly indurate, subcoriaceous, yellowish white, usually 1-vittate lower portion and lanceolate (outermost) to deltoid, loose or reflexed, herbaceous apex (the innermost with an appressed subherbaceous tip), more or less densely strigose and strigillose on the herbaceous apex, the outermost so nearly throughout; receptacle slightly convex; rays 12 to 18, linear-oblong, barely emarginate, 7 to 13 mm. long, 2 to 3 mm. wide; disk corollas glabrous except for the hispidulous teeth, slender, 4.5 to 6.8 mm. long (tube 1.5 to 2.2 mm.); pales narrow, carinate, acute to acuminate, hispidulous-ciliolate at apex, 6 to 9 mm. long; achenes oblong, blackish, sparsely strigillose, winged, 3.5 to 4.5 mm. long, 0.7 to 1.5 wide; awns 2, fragile, unequal, minutely ciliolate, slender, 3.5 to 4.5 mm. long; squamellae 6 to 12, subequal, 0.6 to 1.2 mm. long, lacerate, united below into a cup on the somewhat constricted achene apex.

TYPE LOCALITY: Moyobamba, Peru.

SPECIMENS EXAMINED:

PERU: Moyobamba, 1835, *Mathews* 1383 (type collection; B, G, K). Lamas, 1835, *Mathews* 1384 (K). Sandy plains near Tarapoto, 1855, *Spruce* 3922 (B, G, K).

Like the last, this species has neutral rays and is a true *Oyedaea*, although included in *Zexmenia* by W. W. Jones. It is distinguished from *O. reticulata*, its closest ally, by its broadly round-based leaves and looser inflorescence.

4. *Oyedaea reticulata* Blake, sp. nov.

Shrub or "herb"; stem brown, densely and somewhat harshly appressed-pilose and glandular; leaf blades 8.5 to 10.5 cm. long, 2.5 to 4.3 cm. wide, ovate-lanceolate or ovate, acuminate, at base cuneate, regularly crenate-serrate with 17 to 20 pairs of depressed mucronulate teeth, penninerved with about 8 pairs of veins and obscurely triplinerved, reticulate beneath, above dull green, harshly tuberculate-strigillose, below rather harshly pilose-hispid and glandular; petioles flattened, subappressed-pilose and glandular, 0.8 to 1.2 cm. long; heads several at apex of branches, on terminal and axillary 1 to 5-headed peduncles 2.5 cm. long or less, 2.3 to 3 cm. wide; disk 1.2 cm. high, 1 to 1.5 cm. thick; involucre 4-seriate, slightly graduated, 8 to 9.5 mm. high, the outer phyllaries triangular-ovate, acute, ciliate and glandular-pilose, below indurate and coriaceous, the 1-nerved herbaceous apex spreading, the inmost phyllaries subobtuse, submembranaceous; rays about 12, yellow, oblong, glandular-pubescent on back, 7.5 to 12 mm. long, 3 to 3.5 mm. wide; disk corollas yellow, puberulous on teeth, 5.3 mm. long (tube 0.8 mm.); pales firm, subscarios, very acute, narrowly carinate, more or less puberulous, 9 to 9.5 mm. long; achenes black, sparsely pubescent, narrowly oblong, rugulose, very narrowly winged, 5.7 to 6 mm. long, 1.1 to 1.5 mm. wide; awns 2, fragile, unequal, spinulose, 4.5 to 5.5 mm. long; squamellae about 12, unequal, about 1.4 mm. long, lacerate, united to middle into a corona.

Type in the British Museum, collected at Caqueza, Colombia, at an altitude of 1,800 meters, by J. Triana (no. 1383); also in the Kew Herbarium; photograph and fragments in the Gray Herbarium.

ADDITIONAL SPECIMEN EXAMINED:

COLOMBIA: Moist bank, altitude 1,400 to 1,500 meters, Monte Redondo to Quetame, Cundinamarca, 1917, *Pennell* 1860 (N. Y. Bot. Gard.).

This species is distinguished from *O. wedelioides* by its narrower cuneate-based leaves and often crowded heads; from *O. rusbyi* and *O. lanceolata* by its larger involucre and the longer pubescence of its leaves.

5. *Oyedaea rusbyi* Blake, sp. nov.

Shrub with erect branches; stem terete, pale brown, densely tuberculate-strigillose and hispid-strigose with tuberculate-based hairs, at length glabrate; leaf blades 4.5 to 9.5 cm. long, 1.8 to 3.5 cm. wide, oblong-ovate to lance-ovate, acute to acuminate, mucronate, at base rounded, obscurely appressed-serrulate, slightly revolute, penninerved with 10 to 15 pairs of lateral veins, above dull green, rugulose and impressed-nerved, densely and very harshly tuberculate-strigillose, beneath scarcely paler, venose-reticulate, densely, nearly uniformly, and somewhat harshly pilosulous-hispidulous with spreading hairs, along the veins strigillose-hispidulous with subtuberculate-based hairs; petioles unmarginated, densely tuberculate-strigose, 4 to 10 mm. long; heads 1.8 to 2.1 cm. wide, numerous, cymose-panicled at tips of branches; pedicels densely hispidulous, 7 to 14 mm. long; disk 8 to 10 mm. high, 8 to 12 mm. thick; involucre 4 to 5-seriate, strongly graduated, 4 to 5 mm. high, the phyllaries triangular-ovate to (innermost) oblong-ovate, below strongly indurate and subcoriaceous, ciliate, on back sparsely strigillose or glabrous, the short, abruptly herbaceous, reflexed or spreading, deltoid apex subacute or obtuse; rays about 12, yellow, narrowly oblong, 9 to 10 mm. long, 1.8 to 2.5 mm. wide; disk corollas yellow, puberulous on teeth, with very slender tube and cylindric-funnelform throat, 5.7 mm. long (tube 1.8 to 2 mm.); pales narrow, carinate, acuminate, at apex minutely ciliolate, 8 to 8.5 mm. long; achenes (very immature) appressed-pubescent; awns 2, equal, 1.8 mm. long; squamellae about 8, lanceolate, acuminate, lacerate, united to middle into a cup.

Type in the United States National Herbarium, no. 26728, collected at Reis, Bolivia, at an altitude of 455 meters, June, 1886, by H. H. Rusby (no. 2138). Also in the British Museum, the Gray Herbarium, and the Kew Herbarium.

The type collection of this species was originally recorded by Britton⁹ as a "*Calea* probably undescribed," and has generally been referred in herbaria to *Zexmenia* or *Viguiera*. It represents, however, a typical species of *Oyedaea*, distinguished from *O. lanceolata*, its nearest ally, by its smaller involucre and by having its leaves densely hispidulous-pilosulous beneath.

6. *Oyedaea lanceolata* (Rusby) Blake.

Calea lanceolata Rusby, Bull. N. Y. Bot. Gard. 8: 132. 1912.

Shrub, 1.3 to 6.6 meters high, the trunk 6.5 cm. in diameter or less; stem lepidote-tuberculate below, above tuberculate-hispid-strigose and finely hispidulous; leaf blades 3.3 to 11 cm. long, 1 to 3.5 cm. wide, lanceolate or ovate-lanceolate, acuminate, at base cuneate or rounded-cuneate, entire or obscurely serrulate, somewhat revolute, penninerved with about 12 pairs of veins, green on both sides, above very harshly tuberculate-strigose and strigillose, in age tuberculate, beneath spreading-hispidulous and gland-dotted, along the veins hispid; petioles slender, densely tuberculate-hispidulous and glandular, 3.5 to 12 mm. long; heads numerous, cymose-paniculate, 2.1 to 2.8 cm. wide; pedicels densely hispid and hispidulous, 2 to 20 mm. long; disk 10 to 11 mm. high, 8 to 10 mm. thick; involucre 4-seriate, graduated, 4.8 to 6 mm. high, the outer phyllaries oblong-ovate, the inner oblong, obtuse or rounded, rarely subacute, ciliate or ciliolate and above more or less glandular-strigillose, below indurate, yellowish, with subherbaceous, usually spreading, triangular apex, the inner scarcely at all herbaceous; rays 10 to 12, golden, oblong, 2 or 3-denticulate, 7 to 10 mm. long, 2.8 to 3.5 mm. wide; disk corollas yellow, puberulous on teeth, with cylindric-funnelform throat, 4 to 5.3 mm. long (tube 1 to 2 mm.); pales acute, strigillose, 5.8 to 7 mm. long; achenes oblong, appressed-pubescent, 4.8 mm. long, narrowly winged; awns 2, unequal, 1.8 to 3.5 mm. long, united at base with about 12 unequal squamellae into a corona about 0.8 mm. long.

TYPE LOCALITY: Apolo, Bolivia.

⁹ Bull. Torrey Club 19: 151. 1892.

SPECIMENS EXAMINED:

BOLIVIA: Apolo, altitude 1,465 meters, 1902, *Williams* 317 (B, N, photo. and fragm. G); July 9, 1902, *Williams* 1408 (type; N. Y. Bot. Gard.).

This species is distinguished from *O. rusbyi*, its nearest relative, by its more lanceolate leaves, which are less densely pubescent beneath.

7. *Oyedaea boliviana* Britton, Bull. Torrey Club 19: 149. 1892.

Helianthus mandonii Schultz Bip. Bull. Soc. Bot. France 12: 79. 1865, nomen nudum.

Oyedaea pearcei Rusby, Mem. Torrey Club 3: 59. 1893.

Evergreen shrub, 2 to 2.6 meters high, much branched; stem stout, terete, fuscous-brown, rather densely hispidulous or hispid-pilose with spreading or incurved hairs and sordid-glandular, especially on the younger parts, in age subglabrate but tuberculate below; leaf blades 8.5 to 17 cm. long, 1.3 to 7.5 cm. wide, ovate or broadly ovate to lance-ovate or the uppermost lanceolate, acuminate, cuneate to rounded-cuneate at base, triplinerved (sometimes obscurely so) and rather veiny, obscurely appressed-serrulate (the teeth mucronate, 29 pairs or less) or the upper subentire, above dark green, hispidulous and hispid with incurved hairs with tuberculate persistent bases, in age subglabrate, beneath slightly paler, rather densely hispidulous-pilosulous with incurved-spreading, harsh or soft hairs with scarcely swollen bases, more or less hispid along the veins, and gland-dotted; upper leaves much reduced; petioles 4 to 18 mm. long, pubescent like the stem and distinctly ciliate; heads rather numerous, 1.8 to 3 cm. wide, ternately arranged at ends of branches and branchlets, on pedicels 2 to 28 mm. long or less; disk 7.5 to 10 mm. high, 7 to 10 mm. thick; involucre 3 to 4-seriate, graduated, 4.5 to 7 mm. high; phyllaries ovate to oblong-ovate, with pale, strongly indurate and thickened, mostly 1-vittate base, more or less hispidulous and hispid with appressed hairs chiefly along middle and on margin (where the hairs are spreading) or sometimes all over, and shorter, acute or acuminate, deltoid or triangular, loose or reflexed, herbaceous apex, the innermost with drier paler tips; receptacle flattish; rays about 12, oval to linear-oblong, hispidulous on nerves of back, 8 to 18 mm. long, 2.5 to 4 mm. wide; disk corollas slender, puberulous on teeth, otherwise glabrous, 4.5 to 6.8 mm. long (tube 1.5 to 2.2 mm.); pales narrow, carinate, puberulous and gland-dotted at apex, acutish to acuminate, 7 to 8 mm. long; achenes (nearly mature) flattish, blackish brown, sparsely strigose on sides, ciliate on the narrow wings, 3.5 mm. long, contracted above into a more broadly winged short neck; awns 2, unequal, 3.7 mm. long or less, decurrent into the wings; corona 0.7 mm. high, of about 4 pairs of squamellae united to above the middle.

TYPE LOCALITY: Yungas, Bolivia.

SPECIMENS EXAMINED:

BOLIVIA: Yungas, altitude 1,830 meters, 1885, *Rusby* 2143 (type of *O. boliviana*; herb. Columb. Coll.); in 1890, *Bang* 546 (type collection of *O. pearcei*; B, G, K, N). Santa Cruz, July, 1865, *Pearce* (B, K, fragm. G.). Vicinity of Yungas, altitude 2,100 meters, 1906, *Buchtien* 190 (N. Y. Bot. Gard.). Polo-polo near Coroico, altitude 1,100 meters, 1912, *Buchtien* 3945 (N. Y. Bot. Gard.). Near Ananea, Province of Larecaja, January, 1860, *Mandon* 37 (type collection of *Helianthus mandonii*; B, fragm. G). Near Sorata, Province of Larecaja, *Mandon* (G).

This species is usually readily distinguishable from its relatives by its distinctly triplinerved leaves. Although it is somewhat variable in leaf shape, it is impossible to recognize more than one species in the moderately extensive material I have examined. The reference of this species to *Helianthus* by Schultz Bipontinus, in his enumeration of Mandon's Bolivian Compositae, is an indication of the haste or carelessness with which that usually well-informed specialist must have made his determinations of those plants.

8. *Oyedaea verbesinoides* DC. Prodr. 5: 577. 1836.

Viguiera acuminata Benth.; Oerst. Naturhist. For. Kjöbenhavn Vid. Medd. 1852: 91. 1852.

Viguiera macrophylla Benth.; Oerst. Naturhist. For. Kjöbenhavn Vid. Medd. 1852: 92. 1852.

Oyedaea acuminata Benth. & Hook.; Hemsl. Biol. Centr. Amer. Bot. 2: 176. 1881.

Oyedaea macrophylla Benth. & Hook.; Hemsl. Biol. Centr. Amer. Bot. 2: 176. 1881.

Viguiera drymonia Klatt, Leopoldina 1895: Bot. Beibl. 5. 1895.

Stout branched shrub or tree, 3 to 8 meters high; branches terete or striatulate, densely and usually canescently lanate-pilose or hispid-pilose with incurved hairs, their tuberculate bases persistent; leaf blades 7 to 22.5 cm. long, 2 to 9.5 cm. wide, ovate to ovate-lanceolate, long-acuminate, cuneate at base, crenulate-serrulate with 18 to 40 pairs of mucronulate appressed teeth, triplinerved and reticulate-venose, above dull green, often rugulose, somewhat impressed-veined, harshly strigose-pilose or tuberculate-strigose, the tuberculate bases of the hairs persistent, beneath rather densely and often subcanescently short-pilose or hispid-pilose with soft or roughish, spreading to appressed hairs; petioles lanate-pilose to hispid-pilose, 3 to 30 mm. long; heads about 2 to 16 at apex of branches, 3.8 to 5.5 cm. wide, irregularly cymose-panicled, on densely pilose or tuberculate-hispid-pilose and hispidulous pedicels 3 to 38 mm. long; disk 1.1 to 1.7 cm. high, 1.3 to 1.7 cm. wide; involucre 3 to 4-seriate, graduated, 1.1 to 1.6 cm. high, the phyllaries oblong-lanceolate to lanceolate, or the inner rarely obovate-lanceolate, acute to acuminate, at base strongly indurate and often costate, pale, ciliate and more or less strigillose or tuberculate, the usually much longer apex herbaceous, lanceolate to ovate-lanceolate, tuberculate-strigose and strigillose or appressed-pilose, loosely spreading or reflexed; receptacle flat; rays 8 to 14, oblong, bidentate or shortly bilobed, pubescent on back, 1.3 to 2.3 cm. long, 4 to 7 mm. wide; disk corollas very slender, hispidulous on the teeth, 6.5 to 10 mm. long (tube 2.5 to 4 mm.); pales narrow, with slightly erose or denticulate sides above and narrowed acuminate strigillose apex, 8.5 to 14 mm. long; achenes obovate-oblong to cuneate-obovate, blackish or mottled, nearly glabrous or sparsely pilose or strigose, narrowly or sometimes rather broadly winged, 3.5 to 6.2 mm. long, 1 to 3.5 mm. wide; awns 2, sometimes with a pair of shorter ones at base, fragile, slender, unequal, spinulose, 2.5 to 6.5 mm. long; squamellae about 8 to 12, linear-lanceolate, acuminate, lacerate-fimbriate, united below into a cup, 0.8 to 2 mm. long.

TYPE LOCALITY: Vicinity of Caracas, Venezuela. Type collected by Vargas.

ILLUSTRATION: Deless. Icon. Sel. 4: pl. 34. 1839.

SPECIMENS EXAMINED:

COSTA RICA: San José, altitude about 1,300 meters, 1916, *Holway* 356 (G). Tres Ríos, altitude about 1,500 meters, 1915, *Holway* 274 (G). Rodeo de Pacaca, 1891, *Pittier* 3300 (G, K, N). Mount Aguacate, altitude 610 meters, 1851, *Oersted* 104 (type of *V. macrophylla*; K, fragm. G). Irazú, altitude 2,745 meters, 1851, *Oersted* 96, 106 (types of *V. acuminata*; K). Hills above Belmira, near Santa María de Dota, altitude 1,500 to 1,600 meters, 1898, *Tonduz* 11644 (G, K, N). Savannas of Boruca, 1891, *Pittier* 4523 (G). Forests of Boruca, 1891, *Pittier* 4528 (N). Border of forests, Cañas Gordas, altitude 1,100 meters, 1893, *Pittier* 7351 (type of *V. drymonia*; G); in 1897, *Pittier* 11044 (G, N), 11047 (G).

PANAMA: Boquete, 1849, *Seemann* 1590 (K, fragm. G). Among bushes, pastures around El Boquete, altitude 1,000 to 1,300 meters, 1911, *Pittier* 2948 (N).

COLOMBIA (?): "New Grenada," 1842-43, *Linden* 1511 (B, fragm. G).

VENEZUELA: Caracas, *Burchell* (G, K). Savannas, altitude 1,000 to 1,400 meters, Middle Cotiza, near Caracas, 1917, *Pittier* 7048 (N). Savannas, Upper Cotiza, above 1,400 meters, near Caracas, 1917, *Pittier* 7561 (N). Lower Catuche,

altitude 1,000 to 1,200 meters, 1917, *Pittier* 7545 (N). Tovar, *Moritz* (G, K); 1854-55, *Fendler* 680 (G, K). Frequent in subalpine region, 1865, *Ernst* 726 (B). Without definite locality, 1842-43, *Funck* 364 (B, K); in 1865, *Moritz* 1990 (B).

TRINIDAD: *Botanic Garden Herbarium* 3388 (N).¹⁰

Oyedaea verbesinoides, the commonest of this genus in herbaria, is a somewhat variable species, as might be expected from its comparatively wide range. The material from Costa Rica and Panama commonly has leaves more softly and densely pubescent beneath, and broader phyllaries, but the differences between the Central and South American specimens are neither constant nor of much importance, and after study of all the material available I have found it necessary to unite with *O. verbesinoides* both of Bentham's species as well as two manuscript segregates of my own. As thus constituted, the species is readily recognized by its usually large, triplinerved leaves, comparatively large heads, and phyllaries with long herbaceous tips. In Venezuela it is known as "tarilla" and "tara amarilla," according to Pittier.

9. *Oyedaea bahiensis* Baker in Mart. Fl. Bras. 6³: 206. 1884.

Herbaceous perennial; stems decumbent, at apex assurgent, sparsely branched, 30 to 45 cm. long, hispid; leaf blades numerous, linear, acuminate, sessile, narrowed to base, entire, the middle ones 7.5 to 10 cm. long, 6 to 8 mm. wide, the lowest much shorter, oblong, acute, rather firm, green and hispid on both sides; heads 1 to 4, terminal on hispid peduncles 5 to 10 cm. long; involucre campanulate, 1 to 1.2 cm. high, the phyllaries 2-seriate, lanceolate, acute, hispid, foliaceous, the outer longer; rays oblanceolate, 2.5 cm. long, 6 mm. wide; achenes obovate, compressed, 4 mm. long, narrowly winged, the wings produced above into lanceolate teeth; awns about 1 mm. long, twice as long as the minute pappus cup.

TYPE LOCALITY: Bahia, Brazil.

SPECIMEN EXAMINED:

BRAZIL: Province of Bahia, in grassy places, *Martius* (sketch of type; K).

This species, of which I have seen only the sketch of the type in the Kew Herbarium, is distinguished from all other species of the genus by its linear leaves. It may yet prove to belong to *Aspilia*. The description given above is translated from Baker's original.

10. *Oyedaea humboldtiana* (Gardn.) Benth.; Baker in Mart. Fl. Bras. 6³: 206. 1884.

Viguiera humboldtiana Gardn. Lond. Journ. Bot. 7: 398. 1848.

Herbaceous perennial; stems several, erect from a woody root, slender, subsimple or with a few short branches above, strigillose and shortly strigose-pilose, subglabrate below, sparsely leafy, monocephalous, 25 to 35 cm. high; leaves 3 to 5 pairs, remote (the lower smaller), the blades 1.5 to 3.5 cm. long, 7 to 10 mm. wide, oblong to ovate, acute to subobtuse at apex, sharply serrulate above the cuneate-rounded base, appressed-pubescent chiefly along the veins and margin and gland-dotted on both sides, triplinerved; petioles 1.5 mm. long or less, appressed-pubescent; peduncle 3 to 20 cm. long, naked or 1-bracteate, strigillose and strigose; head 4 to 5.8 cm. wide; disk 9 to 11 mm. high, 12 to 17 mm. wide; involucre 2-seriate, the other phyllaries foliaceous, oblong or oblong-spatulate, acutish, denticulate above the middle, appressed-pubescent and gland-dotted, 1.2 to 2.4 cm. long, the inner much shorter, indurate below, herbaceous above, appressed-puberulous, acuminate; rays about 14, oblong, tridenticulate, pubescent on tube, 1.2 to 2.3 cm. long, 5 to 7 mm. wide; disk corollas glabrous, 4.2 mm. long (tube 0.7 to 1 mm.), the throat subcampanulate-funnelform; pales subscarious, narrow, nearly glabrous, abruptly short-acuminate, spinulose-denticulate near apex, 7.5 to 10 mm. long; achenes at full maturity cuneate-obovate, thickened, 4-angled, 4-winged, crustaceous-bullate on the sides, 4.5 to 4.8 mm. long, 3 to 4 mm. wide; awns

¹⁰ Perhaps not a native specimen.

2, unequal, 1.5 to 2 mm. long, united into a cup at base with the 8 to 10 irregularly lacerate, much shorter squamellae.

TYPE LOCALITY: Near Chapadao de Nostra Senhora d'Abadia, Goyaz, Brazil.

SPECIMENS EXAMINED:

BRAZIL: Arid upland campos near Chapadao de Nostra Senhora d'Abadia, Province of Goyaz, May, 1840, *Gardner* 4239 (type collection; G, K). Between Bom Jesus and Fazenda Seca, Province of Goyaz, *Burchell* 7553 (G, K).

Oyedaea humboldtiana is distinct in its herbaceous habit, solitary head, and few small leaves.

11. *Oyedaea trachyphylla* Blake, sp. nov.

Herbaceous (?), trichotomous, leafy; stem stoutish, striate, densely hispid-pilose with loose spreading hairs with persistent tuberculate bases; leaf blades 7.5 to 9 cm. long, 4 to 5.5 cm. wide, ovate or broadly ovate, acuminate, at base broadly cuneate, obscurely serrulate with depressed teeth, slightly revolute, obscurely triplinerved above the base, above dull green, rugulose, harshly tuberculate and tuberculate-strigose, the tubercles thick and persistent, beneath slightly paler, reticulate-venose, scabrous, along the larger veins tuberculate-hispid and hispidulous, gland-dotted, along the ultimate veinlets minutely tuberculate-hispidulous; petioles densely tuberculate-hispid and minutely granulose, scarcely margined, 3 to 7 mm. long; heads 2.5 cm. wide, solitary at tips of branches and in the forks of the stem, on tuberculate-hispid and glandular striate peduncles 2.5 to 4.5 cm. long; disk 9 to 10 mm. high, 9 to 11 mm. thick; involucre 3-seriate, scarcely graduated, 9 to 11 mm. high, the phyllaries oblong, acute, about 3.5 mm. wide, below more or less indurate, pale, subcostate, tuberculate-strigose or strigose-hispid and granular, the apex shorter, loose, rather abruptly herbaceous, tuberculate and tuberculate-strigose; rays yellow, neutral, oblong, hispidulous on back, 6 mm. long, 1.5 mm. wide; disk corollas yellow, strigillose on teeth and at base of throat, 5.5 mm. long (tube 2 mm.); pales narrow, carinate, acute, minutely spinulose-ciliolate at apex, 8 mm. long; achenes fuscous, somewhat thickened, sparsely pilose, 4 mm. long, 2.2 mm. wide, the wings narrow, subauriculi-form at apex of achene, united with the corona; awns 2, linear-lanceolate, about equaling the squamellae and united with them below; squamellae about 12, fimbriate-lacerate, subequal, united into a corona 0.6 mm. high.

Type in the Kew Herbarium, collected near Rio de Janeiro, Brazil, 1878 or 1879, by A. Glaziov (no. 10985). Fragments in the Gray Herbarium.

This species is readily distinguished by its inflorescence.

12. *Oyedaea ovalifolia* A. Gray, Proc. Amer. Acad. 5: 183. 1861.

Oyedaea ampeloides Hemsl. Biol. Centr. Amer. Bot. 2: 176. 1881.

Reclining or climbing shrub, 3 to 6 meters long or more; stem striate, strigillose, in age glabrate but tuberculate; leaf blades 8 to 18.5 cm. long, 5 to 8 cm. wide, oval to ovate, acute or rarely obtuse, apiculate, at base cuneate or rounded, crenate-mucronulate, firmly pergamentaceous, harshly tuberculate-strigillose above, in age lepidote, beneath scarcely paler, sparsely strigillose, with the hairs longer along the veins, triplinerved above the base, reticulate on both sides with even the tertiary veins prominulous; petioles tuberculate-strigillose and sparsely ciliate, 5 to 17 mm. long; heads 3 to 5.5 cm. wide, several or numerous in an open panicle (its spreading branches usually exceeding the leaves), on tuberculate-strigillose pedicels 1.5 to 7 cm. long; disk 9 to 13 mm. high, 11 to 20 mm. wide; involucre 3-seriate, graduated, 4 to 5.5 mm. high, the phyllaries triangular-ovate to oval, obtuse to rounded or the outermost acutish, appressed, strongly indurate, with narrow subherbaceous or subscarios margin, finely tuberculate-strigillose and ciliolate; rays about 12 to 15, narrowly elliptic-oblong, emarginulate, 9 to 24 mm. long, 2 to 5 mm. wide; disk corollas glabrous except for the finely hispidulous teeth, 6 to 6.5 mm. long (tube 1.6 to 1.8 mm.); pales lacerate above, cuspidate-acuminate, strigillose at apex, 7 to

10 mm. long; achenes strongly compressed, cuneate-obovate, blackish, nearly glabrous, the 2 wings usually aristate-dentate at apex, sometimes spinulose-lobulate on margin, 4 to 5.2 mm. long, 2 to 3.2 mm. wide; awns 2, slender, fragile, unequal, 2.5 mm. long or less, each often with 2 much shorter ones at base; squamellae about 10, lanceolate, acute, unequal, united at base into a cup, 0.3 to 0.5 mm. long.

TYPE LOCALITY: On the road to Huautla, Puebla, Mexico.

SPECIMENS EXAMINED:

SAN LUIS POTOSÍ: Tamasopo Canyon, 1890, *Pringle* 3212 (G, N).

PUEBLA: On the road to Huautla, October, 1858, *Ervendberg* 97 (type; G).

Orizaba, *Botteri* 619 (G). Valley of Orizaba, September 8, 1865-1866, *Bourgeau* 2994 (type collection of *O. ampeloides*; G, K, N).

Oyedaea ovalifolia, the only Mexican species of the genus, may be distinguished by its oval or ovate, thickish, merely strigillose leaves, and short involucre of broad blunt phyllaries without distinct herbaceous tips.

DOUBTFUL SPECIES.

OYEDAEA CUERVIANA Triana, Ann. Sci. Nat. IV. 9: 39. 1858.

Stem fruticose, branching; branches appressed-villous-canescens; leaves ovate-lanceolate, acute, triplinerved, remotely and minutely serrulate, with revolute margin, above scabrous-hirtellous, beneath villous, attenuate into the petiole, the petioles pubescent above; heads corymbose, peduncled, the peduncles rather long, naked or usually leafy; involucreal scales pilose without, the outer foliaceous, linear-lanceolate, acute, entire, the inner submembranaceous, obtuse, ciliate; ligules linear; achenes of disk winged, black-dotted.

Grows between Ubalá and Gachala in temperate places, in the Province of Bogotá (Colombia), at an altitude of 1,500 meters.

The above translated description represents all that is known of this plant. The type, according to Triana's catalogue in the British Museum, was numbered 1520 (specimen no. 5).

EXCLUDED SPECIES.

OYEDAEA ANGUSTIFOLIA Gardn. Lond. Journ. Bot. 7: 293. 1848.

This species, based on a collection made by Gardner (no. 2216) between the Rio Camde and Oeiras, Piahy, Brazil, has a cuneate thickened achene with narrow pale but not truly winged margins produced into slight ears at the truncate apex of the achene, and a very narrow cupuliform pappus of united squamellae and two awns. On each side of the achene at base is a subcrustaceous, slightly two-lobed, appressed appendage such as is found in various species of *Aspilia*, to which genus this species clearly belongs. As the name *angustifolia* has already been used twice in the latter genus, the present plant may take the name of *Aspilia cupulata*. Fragments of the type collection are in the Gray Herbarium.

OYEDAEA BONPLANDIANA (Gardn.) Benth.; Baker in Mart. Fl. Bras. 6³: 206. 1884.

Viguiera bonplandiana Gardn. Lond. Journ. Bot. 7: 399. 1848.

This species, based on Gardner 2217 and 2218 from the Province of Piahy, Brazil, has a wingless, cuneate, somewhat 4-angled achene auriculate at apex and cucullate-appendaged at base, as in the preceding species, and must likewise be referred to *Aspilia*, as *Aspilia bonplandiana* (Gardn.) Blake.

OYEDAEA HELIANTHOIDES Triana, Ann. Sci. Nat. IV. 9: 39. 1858.

This species, the type of which I have never seen, is, from description, a species of either *Steiractinia* or *Perymenium*.

OYEDAEA LIPPIOIDES Baker in Mart. Fl. Bras. 6³: 208. 1884.

A Brazilian species, *Dimerostemma lippioides* (Baker) Blake.¹¹

¹¹ Contr. Gray Herb. n. ser. 52: 15. 1917.

OYEDAEA OVATA (Gardn.) Benth.; Baker in Mart. Fl. Bras. 6³: 207. 1884.

Serpaea ovata Gardn. Lond. Journ. Bot. 7: 296. 1848.

Gardner's *Serpaea ovata* is identical¹² with the earlier, long problematical *Dimerostemma brasilianum* Cass.¹³

OYEDAEA ROTUNDIFOLIA Baker in Mart. Fl. Bras. 6³: 208. 1884.

Serpaea rotundifolia Schultz Bip.; Baker in Mart. Fl. Bras. 6³: 208. 1884, as synonym.

This plant is properly known as *Dimerostemma rotundifolium* (Baker) Blake.¹⁴

OYEDAEA SEEMANNII (Schultz Bip.) A. Gray, Proc. Amer. Acad. 19: 10. 1883.

Viguiera seemannii Schultz Bip.; Seem. Bot. Voy. Herald 305. 1856-57.

Dr. Gray's reference of this species to *Oyedaea* was an error, due to the fact that achenes belonging to this genus had become mixed with the type material in the pocket of the sheet in the Gray Herbarium.¹⁵

The plant is properly known as *Viguiera seemannii* Schultz Bip., and is still known only from the original collection by Seemann (no. 2005) in the Sierra Madre of north-western Mexico.

OYEDAEA VESTITA Baker in Mart. Fl. Bras. 6³: 207. 1884.

This is *Dimerostemma vestitum* (Baker) Blake.¹⁶

¹² See Blake, Contr. Gray Herb. n. ser. 52: 15. 1917.

¹³ Bull. Soc. Philom. 1818: 58. 1818.

¹⁴ Contr. Gray Herb. n. ser. 52: 13. 1917.

¹⁵ See Blake, Contr. Gray Herb. n. ser. 54: 78. 1918.

¹⁶ Contr. Gray Herb. n. ser. 52: 11. 1917.

REVISION OF THE GENUS TITHONIA.

By S. F. BLAKE.

INTRODUCTION.

The genus *Tithonia*, originally described in 1789 in Jussieu's *Genera*¹ without citation of species, was adopted by J. F. Gmelin² two years later, and the single known species was given the binomial *T. uniflora*, a name which has been universally displaced by the later *Tithonia tagetiflora*, published by Desfontaines in 1802 with a full description and plate. The same plant, grown by Philip Miller in his Chelsea garden from seed sent presumably from Veracruz by William Houstoun, had been described in the eighth edition of the *Gardeners' Dictionary* in 1768 as *Tagetes rotundifolia*, and as this is the earliest binomial given the species it must now be known as *Tithonia rotundifolia*. It is a showy annual with large, orange or golden-yellow heads, much like the common sunflower in appearance except for the yellow disk, and seems worthy the attention of horticulturists.

As here recognized, the genus *Tithonia* includes ten species, native from northern Mexico to Panama. One species, *T. rotundifolia*, occurs also in the Greater and Lesser Antilles, and in Venezuela (where certainly introduced), and another, *T. diversifolia*, has become a weed in Ceylon and Burma and at Singapore. As the relationships of the genus to *Helianthus* and *Viguiera* have already been considered in some detail by the writer in another publication,³ only brief notice of them is necessary here. The typical pappus-bearing members of the genus are separated from *Helianthus* by their persistent pappus of awns and squamellae, and from *Viguiera* chiefly by their fistulose peduncles and by certain details of involucre. The four species in which the achene is always glabrous and the pappus wanting, together with *T. brachypappa*, in which glabrous epappose achenes occur in the same head with pubescent pappiferous ones, are to be distinguished from the species of *Viguiera* in which the pappus is likewise absent chiefly by their fistulose peduncles.

Tithonia, being originally based on a species with pappiferous achenes, has by Bentham and Gray been restricted to such species, the plants of similar habit but with epappose achenes being referred to *Gymnolomia*. Schultz Bipontinus, describing *Tithonia calva* in

¹ Desf.; Juss. Gen. Pl. 189. 1789.

² Syst. Nat. 1259. 1791.

³ Contr. Gray Herb. n. ser. 54: 8-10, 19, 21. 1918.

the Botany of the Herald, founded on it the subgenus *Mirasolia*, characterized by its glabrous epappose achenes. In Bentham and Hooker's *Genera Plantarum* *Mirasolia* was raised to generic rank, and included Schultz's species and one earlier described by Bentham as *Tithonia scaberrima*. Schultz's name *Perymeniopsis*, published only in synonymy by Klatt, was, if Klatt's disposition may be trusted, based on the latter species. *Tithonia* was taken by O. Hoffmann in the *Pflanzenfamilien* to include both pappose and epappose species, and the propriety of this treatment has been shown by the writer in the introduction to his Revision of *Viguiera* cited above.

The name *Tithonia*, from Tithon, consort of Aurora, was given by Desfontaines in allusion to the orange rays of his species. Otto Kuntze, rejecting *Tithonia* because of the use by Linnaeus in 1735 of the name *Tithona* for the genus later named by him *Rivina*, proposed *Urbanisol* as a substitute, a name which may be relegated to synonymy under both the American and the International Codes of Nomenclature.

SYSTEMATIC TREATMENT.

TITHONIA Desf.

Tithonia Desf. (Juss. Gen. Pl. 189. 1789, hyponym); Gmel. Syst. Nat. 1259. 1791.

Tithonia subgenus *Mirasolia* Schultz Bip.; Seem. Bot. Voy. Herald 305. 1856-57.

Mirasolia Schultz Bip.; Benth. & Hook. Gen. Pl. 2: 367. 1873.

Urbanisol Kuntze, Rev. Gen. Pl. 1: 370. 1891.

Herbaceous or shrubby; leaves alternate or sometimes opposite below, linear-lanceolate to ovate, triplinerved; heads medium or large, heterogamous, yellow, the rays neutral, 1-seriate, the disk flowers numerous, fertile; involucre hemispheric or broadly campanulate, 2 to 5-seriate, graduated or subequal, the phyllaries lanceolate to oblong or oval, indurate, ribbed, and vittate below, with herbaceous or membranaceous-chartaceous, rounded to acute tips; receptacle convex, the pales rigid, striate, usually aristate-acuminate, concave and embracing the achenes, persistent; ray corollas 8 to 20, oblong to oval, emarginate or tridenticulate; disk corollas with slender tube, longer cylindric or funnellform throat, and 5-toothed limb; anthers cordate-sagittate at base, with ovate appendages; style branches slender, recurved, dorsally hispid above, with lanceolate or linear-lanceolate, acuminate, hispid sterile appendages; achenes oblong, strongly thickened or subquadrangular, pubescent or glabrous; pappus of one or two paleaceous awns and 4 to 12 free or united squamellae, or of more or less united squamellae only, or entirely wanting.

Type species, *Tithonia uniflora* Gmel., which is *T. rotundifolia* (Mill.) Blake.

KEY TO SPECIES.

Phyllaries 2 or 3-seriate, subequal or the outer longer, all with long loose acute herbaceous tips, or the inner rarely with mucronulate or obtuse membranaceous-chartaceous tips, but then shorter than the outer.

Leaves ovate, long-petioled; involucre 1.3 to 3 cm. high; pappus present.

Involucre and apex of peduncles densely hispid-pilose with long hairs; pale long-aristate; leaves not lobed.....1. *T. tubaeformis*.

Involucre and apex of peduncles pilosulous or rarely short-pilose, in age often glabrate; pales acuminate to short-aristate; leaves often 3-lobed.

2. *T. rotundifolia*.

Leaves linear-lanceolate to narrowly lance-ovate, subsessile by a cordate-auriculate base; involucre 7.5 to 9 mm. high; pappus none.....6. *T. auriculata*.

Phyllaries 3 to 5-seriate, graduated, at least the inner with rounded or rarely acute, broadened, more or less membranaceous-chartaceous or rarely subherbaceous tips.

Petiole bases strongly auriculate-decurrent.....3. *T. brachypappa*.

Petiole bases sometimes auriculate but never decurrent.

Pappus present.

Leaves unlobed.

Plant annual; stem sparsely hispid-pilose.....4. *T. thurberi*.

Plant shrubby; stem densely and canescently pilose-tomentose.

9. *T. fruticosa*.

Leaves 3 to 5-lobed, or the upper sometimes entire.

Leaves densely and usually canescently pilosulous beneath.

10. *T. diversifolia*.

Leaves green beneath, merely sparsely puberulous or nearly glabrous except on the veins.....10a. *T. diversifolia glabriuscula*.

Pappus none.

Innermost phyllaries acute or rarely obtuse at apex.

Leaves lance-ovate to ovate, distinctly petioled.

Stem densely silky-villous with long spreading hairs; disk 2.5 to 3 cm. thick.....5. *T. calva*.

Stem hispid-pilose or pilose with short hairs; disk 1.2 to 2.2 cm. thick.

5a. *T. calva lancifolia*.

Leaves linear-lanceolate to lance-ovate, sessile, cordate-auriculate at base.....6. *T. auriculata*.

Innermost phyllaries broadly rounded at apex.

Heads medium-sized, the disk 1.1 to 2 cm. thick; stem hispidulous and sparsely hispid-pilose.....7. *T. pittieri*.

Heads large, the disk usually 2 to 3.5 cm. thick; stem usually densely hispid-pilose.....8. *T. scaberrima*.

1. *Tithonia tubaeformis* (Jacq.) Cass. Dict. Sci. Nat. 35: 278. 1825.

Helianthus tubaeformis Jacq. Pl. Hort. Schönbr. 3: 65. pl. 375. 1798.

Tithonia helianthoides Weinm.; Steud. Nom. Bot. ed. 2. 2: 689. 1841, as synonym.

Urbanisol tubiformis Kuntze, Rev. Gen. Pl. 1: 371. 1891.

Tithonia tubaeformis var. *bourgaeana* Pampanini, Bull. Soc. Bot. Ital. 1908: 134. 1908.

Erect branching annual, 1 to 2 meters high; stem densely and rather harshly hispid-pilose with spreading hairs with several-celled subglandular base, in age subglabrate below; leaves alternate, the blades 7 to 18 cm. long, 3.8 to 14.8 cm. wide (excluding the margined apex of the petiole), ovate to deltoid-ovate, not lobed, acuminate, cuneately narrowed from a truncate or subcordate base into the petiole, crenate-serrate or dentate, 3-nerved, deep green above, harshly hispid-pilose with slightly tuberculate-based hairs, beneath paler, densely gland-dotted, canescent or subcanescent with dense incurved hairs, in age often green, subglabrate, and harsh, the uppermost much smaller and lanceolate; petioles hispid-pilose, subglabrate, scarcely margined below, 1.5 to 10 cm. long; peduncles usually strongly clavate above, densely and canescently hispid-pilose near the head, 30 cm. long or less; heads 4 to 9 cm. wide; disk in anthesis 1.2 to 1.8 cm. high, 1.5 to 3.3 cm. wide, in fruit 1.5 to 2.5 cm. high; involucre 2 or 3-seriate, 1.5 to 3 cm. high, densely and canescently pilose or hispid-pilose with long spreading hairs, the phyllaries lanceolate or oblong-lanceolate (1.5 to 4, rarely 5.5 mm. wide), acute or acuminate, subequal or obgraduated, with indurate ribbed base and longer, slightly broader, loose, herbaceous tip; rays 12 to 14, golden-yellow or orange, elliptic, 3.3 cm. long or less; disk corollas yellow, slenderly tubular, hispidulous chiefly on the swollen base of the throat, subglabrous

above except on teeth, 6 to 7 mm. long, the very short tube only 0.5 mm. long; pales finely tuberculate-hispidulous above, long-aristate; achenes strongly thickened, pilose, 4.5 to 5.5 mm. long; awns 2, lanceolate, acute or aristate-acuminate, unequal, 1 to 3.5 mm. long; squamellae about 12 to 14, more or less united, lacerate-fimbriate, 0.3 to 1.2 mm. long.

TYPE LOCALITY: Mexico.

ILLUSTRATIONS: Jacq. Pl. Hort. Schönbr. 3: pl. 375. 1798; Lindl. Bot. Reg. 18: pl. 1519. 1832.

SPECIMENS EXAMINED:

CHIHUAHUA: Valley near Chihuahua, 1886, *Pringle* 768 (N).

DURANGO: Santiago Papasquiaro, 1896, *Palmer* 420 (N). Tepehuanes, 1906, *Palmer* 277 (N). Durango, 1896, *Palmer* 690 (N), 691 (N). Rincón, 1895, *C. & E. Seler* 1145 (N).

SAN LUIS POTOSÍ: Without definite locality, altitude 1,830 to 2,440 meters, 1878, *Parry & Palmer* 456 (N), 459 (N); in 1880, *Schaffner* (K).

TEPIC: In 1892, *Palmer* 1851 (N).

JALISCO: Río Blanco, 1886, *Palmer* 900 (N).

AGUASCALIENTES: Aguascalientes, 1903, *Rose & Painter* 7755 (N).

VERACRUZ: Orizaba, *Botteri* 507 (N); in 1865, *Bourgeau* 3244 (K). Zacuapan, 1916, *Purpus* 7558 (N). Mirador, 1838, *Linden* 1174 (K).

COLIMA: Manzanillo, 1890, *Palmer* 1076 (N). Without definite locality, 1891, *Palmer* 1220 (N).

MEXICO (STATE): Tacubaya, 1865-66, *Bourgeau* 152 (K, N). Near Guadalupe, 1903, *Rose & Painter* 7273 (N). Valley of Mexico, December 20, 1865, *Bourgeau* 1566 (type collection of *T. tubaeformis* var. *bourgaeana*; K).

PUEBLA: Teocalli de Cholula, 1908, *Arsène* (N). Rancho Posadas, near Puebla, 1909, *Nicolas* (N).

MORELOS: Valley, Jojutla, altitude 915 meters, 1901, *Pringle* 9306 (N).

OAXACA: Sierra de San Felipe, altitude 2,135 to 2,440 meters, 1894, *C. L. Smith* 617 (N). Mountain ridge on west side, valley of Cuicatlán, altitude 1,980 to 2,400 meters, 1894, *Nelson* 1899 (N). Maize fields, Cordillera of Oaxaca, 1840, *Galeotti* 2003 (K).

GUATEMALA: Chupadero, altitude 1,525 meters, 1892, *Heyde & Lux* 4204 (N). Pacaya, Department of Amatitlán, altitude 1,765 meters, 1890, *J. D. Smith* 2390 (N). Santa Rosa, Baja Verapaz, 1904, *Cook* 233 (N). Huehuetenango, 1914, *Tejada* 329 (N). Dueñas, 1861, *Salvin & Godman* (K). Without definite locality, 1865, *Bernoulli* 162, 217 (K).

This species is closely related to the next, but is generally easily distinguished by the long dense pubescence of the involucre and peduncles, the long-aristate pales, and the always unlobed leaves. In Oaxaca, according to Galeotti, it is known as "camalote." It is known in Mexico also as "acaute" and "acahuale."

2. *Tithonia rotundifolia* (Mill.) Blake, Contr. Gray Herb. n. ser. 52: 41. 1917.

Tagetes rotundifolia Mill. Gard. Dict. ed. 8. *Tagetes* no. 4. 1768.

Tithonia uniflora Gmel. Syst. Nat. 1259. 1791.

Tithonia tagetiflora Desf. Ann. Mus. Hist. Nat. 1: 49. pl. 4. 1802.

Helianthus speciosus Hook. in Curtis's Bot. Mag. 61: pl. 3295. 1834.

Leighia ? *speciosa* DC. Prodr. 5: 583. 1836.

Tithonia aristata Oerst. Naturhist. For. Kjöbenhavn Vid. Medd. 1852: 114. 1852.

Tithonia heterophylla Griseb. Bonplandia 6: 9. 1858.

Tithonia speciosa Hook.; Griseb. Cat. Pl. Cub. 155. 1866.

Tithonia macrophylla S. Wats. Proc. Amer. Acad. 26: 140. 1891.

Urbanisol tagetifolius Kuntze, Rev. Gen. Pl. 1: 370. 1891.

Urbanisol tagetifolius α *normalis* Kuntze, Rev. Gen. Pl. 1: 370. 1891.

Urbanisol tagetifolius β *speciosus* Kuntze, Rev. Gen. Pl. 1: 370. 1891.

Urbanisol aristatus Kuntze, Rev. Gen. Pl. 1: 371. 1891.

Urbanisol heterophyllus Kuntze, Rev. Gen. Pl. 1: 371. 1891.

Tithonia vilmoriniana Pampanini, Bull. Soc. Bot. Ital. 1908: 133. 1908.

Stoutish erect branched annual, up to 2 meters high; stem pale or purplish, striatulate, the younger parts densely pilosulous or canescent with rather short soft spreading hairs with slightly enlarged bases, in age subglabrate; leaves alternate, the blades 7 to 27 cm. long (excluding the cuneate decurrent base), 4 to 19.5 cm. wide, ovate to deltoid-ovate, three-lobed near the middle with subcaudate lobes or entire, acuminate, abruptly cuneate-decurrent into the petiole from a rounded or slightly cordate base, serrate with depressed-deltoid teeth, thin, 3-nerved, hispid-pilose on both sides along the veins with slightly harsh hairs and rather densely tuberculate-hispidulous between them, gland-dotted and slightly paler beneath; petioles scarcely margined below, spreading-pilose, 2 to 14 cm. long; peduncles striatulate, pubescent like the stem but in age glabrate except just below the heads, usually fistulose above, naked or with a few leafy bracts, 30 cm. long or less; heads 4 to 8 cm. wide; disk in anthesis 1.5 to 2 cm. high, 2 to 3 cm. thick, in fruit 2 to 3.5 cm. thick; involucre 2-seriate, subequal or obgraduated, 1.3 to 2.8 cm. high, the outer phyllaries ovate to ovate-oblong or sometimes lanceolate, acute or acuminate, finely subcanescent-pilosulous, in age sometimes subglabrate, indurate, pale, and multistriatulate about to the middle, the herbaceous apex reflexed or loose, the inner similar but usually much shorter, and with shorter, less herbaceous apex; rays 9 to 13, golden-yellow or orange, 2 to 2.5 cm. long; disk corollas yellow, slenderly tubular, puberulous especially at base of throat and on the teeth, 9 mm. long, the throat strongly dilated at maturity, the tube 1 to 1.5 mm. long; pales stiff, lanceolate, cuspidate-acuminate, striatulate, hispidulous above, the outer and sometimes the inner becoming purplish above, 1.2 to 1.8 cm. long; achenes subquadrangular, often striate, blackish or mottled, appressed-pilose or ascending-pilose, 6 to 7 mm. long; awns 2, easily deciduous, minutely strigillose, unequal, 4 to 6.2 mm. long; squamellae firm, united nearly or quite to apex, irregularly dentate, spinulose at apex, 2 to 2.2 mm. long.

TYPE LOCALITY: Veracruz.

ILLUSTRATIONS: Lam. Tabl. Encycl. 3: pl. 708. 1798; Ann. Mus. Hist. Nat. 1: pl. 4. 1802; Lindl. Bot. Reg. 7: pl. 591. 1822; Curtis's Bot. Mag. 61: pl. 3295. 1834.

SPECIMENS EXAMINED:

COAHUILA: Vicinity of Saltillo, 1898, *Palmer* 558 (N).

TEPIC: Cuesta de San Luisito, Sierra Madre, altitude 1,370 meters, 1905, *Goldsmith* 168 (G).

JALISCO: Barranca of Tequila, 1893, *Pringle* 4601 (G, N). Barranca near Guadalajara, September 25, 1889, *Pringle* 2798 (type collection of *T. macrophylla*; G, N). Near Guadalajara, 1903, *Rose & Painter* 7405 (N). On road between Bolaños and Guadalajara, 1897, *Rose* 3053 (G, N).

VERACRUZ: *Houstoun* (type of *Tagetes rotundifolia*; B).

COLIMA: Colima, 1891, *Palmer* 1250 (N).

GUERRERO: Plain of Iguala, altitude 730 meters, 1900, *Pringle* 9058 (G, N). Acapulco, *Sinclair* (K); in 1894-95, *Palmer* 631 (N).

YUCATÁN: *Gaumer* 899 (N).

GUATEMALA: Mazatenango, altitude 330 meters, 1905, *Kellerman* 5139 (N). In cultivated field, Gualán, altitude 125 meters, 1905, *Deam* 333 (N). Escuintla, altitude 335 meters, 1890, *J. D. Smith* 2380 (N), 2385 (N). San Sebastián, altitude 305 meters, 1891, *Shannon* (*J. D. Smith*, no. 596; N).

SALVADOR: Vicinity of Izalco, altitude 400 to 800 meters, 1907, *Pittier* 1976 (N). San Salvador, 1905, *Velasco* (*J. D. Smith*, no. 8869; N). Without definite locality, *Renson* 19 (N).

NICARAGUA: Granada, 1870, *Lévy* 279 (K). Realejo, *Sinclair* (K).

COSTA RICA: Nicoya, 1899, *Tondus* 13614 (N). Ojo de Agua, *Hoffmann* 349 (G). San José, 1851, *Oersted* 107 (K).

PANAMA: Between Aguadulce and Río Chico, Coclé, altitude 20 meters, 1911, *Pittier* 5009 (N). Taboga Island, 1912, *Celestino* 41 (N).

CUBA: Without definite locality, *Drummond* (K). Vicinity of Vento, Havana, 1904, *Wilson* 1325 (N).

SANTO DOMINGO: Without definite locality, 1871, *Wright, Parry & Brummel* 267 (N).

PORTO RICO: Near Coamo, 1885, *Sintenis* 3179 (N). Coamo Springs, 1899, *Cook & Collins* 707 (N); in 1901, *Underwood & Griggs* 509 (N).

MONTSERRAT: Roadside near Grove, 1907, *Shafer* 129 (N).

GUADELOUPE: Rather rare, Désirade, 1892 and 1894, *Duss* 2806 (N).

MARTINIQUE: Scarce, Rivière-Salée, 1903, *Duss* 4682 (G, N).

ST. VINCENT: Introduced and sparingly naturalized, *H. H. & W. G. Smith* 1222 (K).

VENEZUELA: Waste places (introduced), Agua Salud, Caracas, 1917, *Pittier* 7435 (N).

CULTIVATED: Garden of Montpellier, *Delile* (K). Jardin des Plantes, Paris, October 19, 1839, *J. Gay* (K). Kew Gardens (type of *Helianthus speciosus*; K). Government House Grounds, Trinidad, 1907, *Broadway* 2880 (K).

This species, whose natural range is the widest of any member of the genus, may be separated from *T. tubaeformis*, its only near relative, by the merely canescent or pilosulous involucre and peduncles, the cuspidate-acuminate, not aristate pales, and the often three-lobed leaves. The types of *T. aristata*, *T. heterophylla*, and *T. vilmoriniana* have not been examined, but from description all clearly belong to *T. rotundifolia*. The type of *T. aristata* was collected by Oersted on Mount Aguacate, Costa Rica, and that of *T. heterophylla* by Duchassaing on Taboga Island, Panama. *T. vilmoriniana* was described from specimens grown in the Botanic Garden of Florence from seed received from Vilmorin-Andrieux, said to have been collected at "Jacona, Mexico." Miller's type was grown at Chelsea Garden from seed sent from Veracruz by William Houstoun about 1730; Desfontaines's from seed sent from the same locality by Thiéry in 1778. The species is well worthy of reintroduction into cultivation. Like its close relative *T. tubaeformis*, it is known in Mexico as "acaute."

Some of the second-growth heads of Donnell Smith's no. 2385 show a curious condition of the disk flowers. The apparently infertile ovaries are linear, 9 mm. long, and the awns are replaced by linear-spatulate, very unequal, flat, 1 to 3-nerved, pilose, upwardly subherbaceous appendages 0.8 to 7.5 mm. long, the longer more or less denticulate above; the squamellae are absent. The style branches are 5.3 to 6 mm. long, including the lance-subulate attenuate appendage, which is 1.3 mm. long, and the anther appendages are lance-ovate, acuminate, 1.5 mm. long. The older heads in these specimens are normal.

3. *Tithonia brachypappa* Robinson, Proc. Amer. Acad. 27: 174. 1892.

Stem herbaceous, slender, striatulate, 2 to 3.3 meters high, sparsely hispid-pilose or hispidulous with spreading, slightly tuberculate-based hairs, subglabrate; leaves alternate, the blades 3 to 6.7 cm. long, 1.6 to 4.7 cm. wide, ovate or triangular-ovate, unlobed or deeply three-lobed with attenuate lobes (the lateral ones sometimes again lobed at base on outer side), cuneate or rounded-cuneate at base, dentate-serrate, hispidulous and rather densely gland-dotted on both sides, with stouter glandular-tuberculate-based hairs along the veins beneath, deep green above, slightly paler beneath; petioles hispid-pilose or hispidulous with tuberculate-based hairs, 1 to 5 cm. long, narrowly or rather broadly margined, at base dilated into serrulate or entire auricles decurrent on stem for 4.8 cm. or less; peduncles striate, fistulose, rather densely hispid-pilose or hispidulous, gland-dotted, 22 cm. long or less; heads 3.5 to 5 cm. wide; disk 1.4 to 1.7

cm. high, 2 to 2.4 cm. thick; involucre 3-seriate, strongly graduated, 12 to 16 mm. high, the phyllaries obovate to cuneate-obovate, bluntly rounded or barely acutish, tuberculate-hispidulous chiefly on the exposed portions and gland-dotted, sometimes sparsely hispid, strongly indurate, pale, and vittate to middle, with broader herbaceous apex, the inmost submembranaceous-herbaceous above and 6 to 8 mm. wide; rays apparently about 8, yellow, oblong-oval, 2 cm. long, 6 mm. wide; disk corollas glandular-hispidulous below, 6 mm. long (tube 0.6 to 0.8 mm.); pales subglabrous, abruptly cuspidate-acuminate, with a tooth on each side below the cusp, 8 to 10 mm. long; achenes subquadrangular, blackish or mottled, glabrous or sparsely appressed, pilose, 5 to 6 mm. long; pappus none, or in achenes of the same head of about 6 basally united dentate squamellae 0.6 to 0.8 mm. long.

TYPE LOCALITY: Las Palmas, San Luis Potosí.

SPECIMENS EXAMINED:

SAN LUIS POTOSÍ: Las Palmas, October 15, 1890, *Pringle* 3675 (type; G).
Limestone hills, Las Palmas, 1894, *Pringle* 6143 (K, N).

Tithonia brachypappa is easily recognized by its auriculate-decurrent petiole bases. This species is remarkable in showing in the same heads calvous glabrous achenes and others which are pubescent, and have a pappus of several basally united squamellae without awns.

4. *Tithonia thurberi* A. Gray, Proc. Amer. Acad. 8: 655. 1873.

Tithonia palmeri Rose, Contr. U. S. Nat. Herb. 1: 104. 1891.

Urbanisol thurberi Kuntze, Rev. Gen. Pl. 1: 371. 1891.

Rather slender branching annual, 0.5 to 2 meters high; stem whitish, striate, sparsely or rather densely tuberculate-hispid-pilose with spreading hairs and finely hispidulous, glabrate; leaves opposite below, alternate above, the blades 5 to 28 cm. long, 3 to 27 cm. wide, ovate to broadly triangular-ovate, unlobed, short-pointed to acuminate, cuneately decurrent into the petiole from a cuneate to broadly cordate base, thin, triplinerved, crenate-dentate with low, broadly triangular, mucronulate teeth, above deep green, tuberculate-hispidulous with incurved hairs and especially along the veins tuberculate-hispid-pilose, beneath paler green, rather sparsely granular or hispidulous and along the veins hispid-pilose; petioles margined to the slightly ampliate, not decurrent base, 2 to 10 cm. long, the margin irregularly toothed in the larger leaves; peduncles striate, fistulose, spreading-hispid-pilose and finely hispidulous, 30 cm. long or less; heads 2.5 cm. wide or more; disk 1.5 to 2 cm. high, 1 to 2.4 cm. thick; involucre 3-seriate, graduated or obgraduated, 1 to 2 cm. high, the two outer series of phyllaries lanceolate, oblong-ovate, or obovate, acute to acuminate, tuberculate-hispid-pilose and hispidulous, with indurate vittate base, usually contracted above, and shorter to longer, ovate to triangular-ovate, loose, herbaceous tip, the innermost broadest, with short, triangular-ovate, submembranaceous-herbaceous, merely granular or strigillose, obtuse or mucronulate tip; rays about 8, orange-yellow, oval-oblong, about 7 to 10 mm. long; disk corollas glandular-pilosulous especially below, hispidulous on teeth, 6.2 mm. long (tube 1 mm.); pales nearly smooth, striate-ribbed, with a tooth on each side below the abruptly cuspidate-acuminate tip, 1 to 1.5 cm. long; achenes oblong-obovate, thickened, appressed-pilose, 8.5 mm. long; awn solitary (on outer angle of achene), linear-subulate, 5.8 to 8 mm. long; squamellae about 4 to 8, lanceolate, very unequal (the central shortest), 4 mm. long or less.

TYPE LOCALITY: Magdalena, Sonora.

SPECIMENS EXAMINED:

SONORA: Magdalena, October, 1851, *Thurber* 910 (type collection; G, K). Along watercourses and in canyons, Alamos, September, 1890, *Palmer* 721 (type collection of *T. palmeri*; G, K, N).

This species may be recognized by its usually sparsely hispid-pilose stem, characteristic involucre, and pappose achenes.

5. *Tithonia calva* Schultz Bip.; Seem. Bot. Voy. Herald 305. 1856-57.

Mirasolia calva Benth. & Hook.; Hemsl. Biol. Centr. Amer. Bot. 2: 168. 1881.

Gymnolomia calva A. Gray; Hook. & Jacks. Ind. Kew. 1²: 1076. 1893.

Stout branching leafy herb; stem in youth densely silky-villous with wide-spreading hairs 5 to 6 mm. long, tardily subglabrate; leaves alternate, the blades 8 to 14 cm. long, 3.3 to 8.5 cm. wide, ovate or triangular-ovate, acute to acuminate, cuneately or abruptly narrowed into the cuneately margined petiole, somewhat irregularly serrate or serrulate with bluntish teeth, triplinerved, above densely and harshly glandular-tuberculate-hispidulous and rather sparsely hispid-pilose, in age subglabrate and lepidote, beneath slightly paler green, densely and finely glandular-hispidulous and especially along veins hispid-pilose with tuberculate-based spreading hairs; petioles 4 to 6 cm. long, margined nearly or quite to base, there usually widened into auricles; peduncles fistulose, spreading-hispid-pilose and finely glandular-hispidulous, 8 cm. long or less; heads 5.5 to 6 cm. wide; disk 1.7 cm. high, 2.5 to 3 cm. wide; involucre 3-seriate, slightly graduated, 13 mm. high, the two outer series of phyllaries lance-ovate (the outermost narrower), acuminate, tuberculate-hispid-pilose and finely tubercular, with ribbed and vittate, subindurate base and equal or shorter, subherbaceous, appressed apex, the innermost series oval, much broader (5 mm.), acute or obtusish, with appressed, subherbaceous, densely tuberculate or tuberculate-hispidulous and sparsely hispid-pilose apex; rays about 13, golden-yellow, oblong, emarginate, finely glandular-hispidulous on back, 18 mm. long, 7 mm. wide; disk corollas hispidulous chiefly at base of tube and on teeth, 6 mm. long (tube 0.6 mm.); pales firm, minutely hispidulous at the abruptly pointed but not cuspidate apex, 9 to 10 mm. long; achenes thickened, glabrous, blackish, 3 to 3.5 mm. long; pappus none.

TYPE LOCALITY: Sierra Madre of northern Mexico. Type collected by Seemann (no. 2045). Sketch in United States National Herbarium.

SPECIMEN EXAMINED:

DURANGO: Without definite locality, August 15, 1897, *Rose* 2293 (N).

Tithonia calva is easily distinguished from the other epappose species by its usually acutish inner phyllaries and densely silky-villous stem.

5a. *Tithonia calva lancifolia* (Robins. & Greenm.) Blake.

Gymnolomia calva var. *lancifolia* Robins. & Greenm. Proc. Bost. Soc. Nat. Hist. 29: 103. 1899.

Stem rather sparsely tuberculate-hispid-pilose with ascending hairs 1 to 2.5 mm. long; leaf blades 5 to 12 cm. long, 1.8 to 4.5 cm. wide, lance-ovate to lanceolate or rarely ovate, acuminate, sometimes subentire, usually cuneate into the margined, often auriculate-based petiole, pubescent like the stem but with more incurved hairs; petioles 1.5 to 4 cm. long; peduncles more slender than in the type form, 2.5 to 8.5 cm. long; heads 4.5 to 5 cm. wide; disk 9 to 12 mm. high, 12 to 22 mm. thick; involucre 9 to 12 mm. high, 3 to 4-seriate, often more sparsely pubescent than in the typical form, the outer phyllaries sometimes with loose tips; disk corollas 5 mm. long; achenes as in the typical form.

TYPE LOCALITY: Acaponeta, Tepic.

SPECIMENS EXAMINED:

TEPIC: Tepic, 1892, *Palmer* 1975 (N). Acaponeta, February, 1895, *Lamb* 539 (type collection; G, N).

Distinguished from the typical form of the species chiefly by its smaller leaves, sparsely hispid-pilose stem, and smaller heads.

6. *Tithonia auriculata* (T. S. Brandeg.) Blake, Contr. Gray Herb. n. ser. 54: 9. 1918.

Gymnolomia auriculata T. S. Brandeg. Zoe 5: 223. 1905.

Herbaceous many-stemmed perennial, 30 to 50 cm. high; stems simple or sparsely branched, pale fuscous, striatulate, densely hispid with tuberculate-based upcurved

hairs and finely hispidulous and gland-dotted; leaves opposite, at least below, usually alternate above, the blades 8.5 to 15.5 cm. long, 8 to 16 mm. wide, linear-lanceolate to narrowly lance-ovate, long-acuminate, at base slightly broadened and cordate-auriculate, obscurely and remotely denticulate, penninerved, rather sparsely hispid-pilose and hispidulous with incurved tuberculate-based hairs on both sides and gland-dotted, slightly paler below; petioles hispid-pilose, 2 mm. long, or obsolete; peduncles naked, slightly fistulose, striate, pubescent like the stem, 8 to 12 cm. long; heads 3.8 to 6 cm. wide; disk 1.2 cm. high, 1.8 to 2.1 cm. thick; involucre 3-seriate, 7.5 to 9 mm. high, the two outer series of phyllaries slightly graduated, lanceolate to oblong, acutish to acuminate, tuberculate-hispid-pilose, toward tip tuberculate-hispidulous, with indurate, ribbed, and vittate base and shorter loose herbaceous apex, the innermost shorter, oblong, indurate to the short deltoid acute mucronulate subherbaceous tip; rays about 15, oval-oblong, emarginate, gland-dotted and finely hispidulous dorsally, 1.4 to 2.4 cm. long, 4 to 6.5 mm. wide; disk corollas pilose or puberulous at base of throat, hispidulous on the teeth, 5 mm. long (tube 0.3 mm.); pales ribbed, abruptly short-pointed, tuberculate-hispidulous above, about 8 mm. long; achenes plump, obscurely quadrangular, blackish, glabrous, 3.5 mm. long; pappus none.

TYPE LOCALITY; Cerro Colorado, Cofradia, Sinaloa.

SPECIMENS EXAMINED:

SINALOA: Cerro Colorado, Cofradia, November 5, 1904, *Brandegge* (type collection; G, N). Openings in woods, road to La Tigre, San Ignacio, 1918, *Salazar* 446 (N).

Tithonia auriculata is easily recognized by its narrowly linear-lanceolate or lance-ovate, subsessile, auriculate-based leaves. It is perhaps most closely related to *T. calva lancifolia*.

7. *Tithonia pittieri* (Greenm.) Blake, Contr. Gray Herb. n. ser. 54: 9. 1918.

Gymnolomia pittieri Greenm. Proc. Amer. Acad. 39: 101. 1903.

Herbaceous, the base not seen; stem slender or stoutish, branched, striatulate, hispid-pilose with short incurved or ascending hairs with slightly enlarged bases and more or less finely hispidulous; leaves opposite below, alternate above, the blades of the middle and upper ones 7.3 to 11 cm. long (including the margined portion of the petiole), 1.5 to 2.3 cm. wide, lanceolate, acuminate, usually oblique or falcate, tapering or somewhat abruptly contracted into a cuneately margined petiole, crenate-serrulate (teeth 5 to 13 pairs, very depressed), above dark green, rather dense¹ hispidulous with tuberculate-based, more or less persistent hairs and gland-dotted, beneath paler or in youth griseous, rather densely incurved-pilose with short hairs scarcely enlarged at base, or hispidulous-pilosulous, gland-dotted, triplinerved and somewhat veiny; naked portion of petiole hispid-pilose and gland-dotted, 2 to 4 mm. long; peduncles fistulose, striate, 2.5 to 11 cm. long, pubescent like the stem; heads 3.5 to 5.5 cm. wide; disk 8 to 15 mm. high, 1.1 to 2 cm. thick; involucre 4-seriate, strongly graduated, 7 to 14 mm. high, the outermost phyllaries oblong or obovate-oval, 3 to 5 mm. long, obtuse or abruptly subacute, indurate and ribbed below with shorter or longer, subherbaceous, appressed or loose tip, rather densely appressed-hispid-pilose or hispidulous and ciliate or ciliolate; the next series indurate and ribbed to middle or above and sparsely tuberculate-hispidulous, with subherbaceous, densely tuberculate-hispidulous and gland-dotted, obtuse or rounded, more or less spreading tip; the inner obovate, 3 to 7 mm. wide, indurate and vittate to above the middle and there subglabrous, with submembranaceous, densely tuberculate, minutely ciliolate and somewhat gland-dotted, broadly rounded or obtuse tip; rays 12, yellow, narrowly oblong, emarginate or bidenticulate, 2.3 cm. long, 4 to 5 mm. wide; disk corollas yellow, in youth cylindraceous, with very obscure proper tube, hispidulous below and on teeth, 5 mm. long, in age developing a short glabrous tube 0.5 to 0.8 mm. long; receptacle convex, strongly tuberculate; pales firm, abruptly acute, usually with a lateral tooth on each side, ribbed, sparsely tuberculate above, in maturity

purplish, 7 to 8 mm. long; achenes thickened, blackish brown, glabrous, slightly striatulate and pustulose or smooth, 3.3 to 3.8 mm. long, the base inclosed by the conspicuous, whitish or at length brownish, scarious-chartaceous development (0.7 mm. long) of the short carpoid; pappus none.

TYPE LOCALITY: Along the Río Ceiba, Buenos Aires, Costa Rica. The species was based on *Pittier* 3136 (in part), from the Río Tiliri, San José; *Pittier* 3735, from the Río Ceibo at Buenos Aires; and *Pittier* 10631, from Ujarras de Buenos Aires, Costa Rica, the second of which is here selected as the type.

SPECIMENS EXAMINED:

GUATEMALA: Hills between Cajval and Cahabón, Alta Verapaz, altitude 400 meters, 1905, *Pittier* 226 (N). Vicinity of Secanquím, Alta Verapaz, altitude 550 meters, 1905, *Pittier* 201 (N).

COSTA RICA: Along the Río Ceiba, Buenos Aires, altitude 200 meters, February, 1891, *Pittier* 3735 (type; G).

Tithonia pittieri may be distinguished from *T. scaberrima* by its smaller heads and more sparsely pubescent stem and leaves.

8. *Tithonia scaberrima* Benth.; Oerst. Naturhist. For. Kjöbenhavn Vid. Medd. 1852: 91. 1852.

Tithonia platylepis Schultz Bip.; Benth. & Hook. Gen. Pl. 2: 368. 1873, nomen nudum.

Mirasolia scaberrima Benth. & Hook.; Hemsl. Biol. Centr. Amer. Bot. 2: 168. 1881.

Gymnolomia platylepis A. Gray, Proc. Amer. Acad. 19: 5. 1883.

Gymnolomia decurrens Klatt, Leopoldina 23: 90. 1889.

Perymeniopsis perfoliata Schultz Bip.; Klatt, Leopoldina 23: 90. 1889, as synonym.

Tithonia glaberrima Kuntze, Rev. Gen. Pl. 1: 371. 1891.

Gymnolomia scaberrima Greenm. Field Mus. Bot. 2: 268. 1907.

Stout branching herb, 1.3 to 5 meters high; stem usually densely pilose or hispid-pilose with spreading hairs and hispidulous, sometimes incurved-hispid; leaves opposite below, alternate above, the blades 8.5 to 17 cm. long (excluding the margined petiole), 2.5 to 9.8 cm. wide, ovate-lanceolate to broadly ovate, rarely lanceolate, acuminate, cuneately or abruptly contracted into the petiole, thickish, crenate-serrate, above scabrous with short incurved hairs with glandular-tuberculate bases, along the veins hispid-pilose, beneath pale or canescent, densely and softly pilosulous or pilose with more or less spreading hairs, triplinerved and rather veiny; petioles cuneately margined nearly to the base, not auriculate, 1 to 3.5 cm. long; heads few, 5 to 7 cm. wide, on fistulose, sparsely or densely hispid-pilose and hispidulous, naked or bracteate peduncles up to 12 cm. long; disk 1.8 to 2.5 cm. high, 1.3 to 3.5 cm. thick; involucre 4-seriate, strongly graduated, 1.2 to 1.8 cm. high, the phyllaries oval or obovate, broadly rounded at tip, the two outer series indurate-subherbaceous, with thinner tip, rather densely hispid-pilose with subtuberculate-based hairs and ciliate or ciliolate, the inner with indurate, more or less pubescent base and submembranaceous, ciliolate, otherwise subglabrous apex; rays yellow, 14 to 18, 2.5 to 3.5 cm. long; disk corollas yellow, puberulous below and on teeth, 5 to 7 mm. long (tube 0.5 to 1.1 mm. long); pales acute or acuminate, not cuspidate, hispidulous or tuberculate toward tip, 8 mm. long; achenes glabrous, slightly thickened, blackish brown, 3 to 4.3 mm. long; pappus none.

TYPE LOCALITY: Coniferous region, vicinity of Chinotega, Province of Segovia, Nicaragua, altitude 1,525 meters.

SPECIMENS EXAMINED:

VERACRUZ: Valley of Córdoba, 1866, *Bourgeau* 1851 (N). Cerro del Borrego, Orizaba, altitude 1,370 meters, 1895, *Pringle* 6087 (N). Hacienda Mirador, altitude 1,095 to 1,220 meters, 1894, *Nelson* 65 (N). Open forests, Zacuapan, 1907, *Purpus* 2183 (N). Rocky soil, Fortín, Zacuapan, 1907, *Purpus* 2852 (N).

OAXACA: Vicinity of Totontepec, altitude 1,675 to 2,135 meters, 1894, *Nelson* 772 (N).

CHIAPAS: Between San Sebastián and Pantepec, 1907, *Collins & Doyle* 211 (N).

GUATEMALA: Cobán, altitude 1,350 meters, 1908, *Türckheim* II. 2053 (N). Near Santa María, Department of Quezaltenango, altitude 1,500 to 1,800 meters, 1905, *Maxon & Hay* 3595 (N). Quezaltenango, altitude 1,980 meters, 1917, *Holway* 729 (G).

SALVADOR: Opaneca, Department of Ohuachapan, altitude 1,460 meters, 1907, *Pittier* 2007 (N).

HONDURAS: Between Llano de la Puerta and El Salto, Copán, altitude 900 meters, 1907, *Pittier* 1854 (N).

COSTA RICA: Along the Río Tiliri, 1892, *Tonduz* 7196 (N).

Tonduz 7196 is peculiar in having the leaves beneath green, merely hispidulous-puberulous, and rather densely gland-dotted, in this respect approaching *T. calva lancifolia*, but it is otherwise typical of *T. scaberrima* and possesses the characteristic involucre of the latter species. *T. scaberrima* is readily told by its densely pubescent stem and leaves, large heads, and large, broadly rounded phyllaries.

9. *Tithonia fruticosa* Canby & Rose, Contr. U. S. Nat. Herb. 1: 104. pl. 5. 1891

Stout shrub, 3 to 4 meters high, the woody stem becoming 10 cm. in diameter, glabrate and clothed with a grayish bark; younger branches densely and canescently pilose-tomentose with spreading hairs; leaves opposite below, alternate above, the blades 6.5 to 30 cm. long, 2.2 to 14 cm. wide, ovate or lanceolate, acuminate or attenuate and often falcate, cuneate into the margined petiole, crenate-serrate, triplinerved and veiny beneath, canescent-pilose on both sides but particularly beneath with rather soft incurved tuberculate-based hairs and gland-dotted; petioles 3 to 5 cm. long, margined but not auriculate; heads terminal and axillary, 7 to 9.5 cm. wide, on fistulose striate peduncles shorter than the leaves; disk 2 to 2.5 cm. high, 2.5 to 4.5 cm. thick; involucre 4-seriate, strongly graduated, 2 to 2.8 cm. high, the phyllaries broadly oval or obovate-oval (the median 8 to 12 mm. wide), broadly round-tipped or rarely obtuse, the outer densely canescent-pilosulous with tuberculate-based appressed hairs, the inmost less pubescent and greenish, all with obscurely indurate base and shorter submembranaceous tip, the inmost with submembranaceous-subherbaceous tip; rays about 14 to 20, yellow, narrowly elliptic, 2 to 3.5 cm. long; disk corollas hispidulous throughout, or only below and on the teeth, 8 to 9 mm. long (tube 1 mm.); pales ovate-lanceolate, stiff, abruptly pointed but not cuspidate, finely tuberculate-hispidulous and gland-dotted above or subglabrate, 12 to 14 mm. long; achenes appressed-pilose, 4 to 5 mm. long; squamellae connate into a laciniate-fimbriate paleaceous crown 1 to 1.5 mm. high, the awns obsolete or represented merely by teeth only twice as long as the crown.

TYPE LOCALITY: Alamos, Sonora.

ILLUSTRATION: Contr. U. S. Nat. Herb. 1: pl. 5. 1891.

SPECIMENS EXAMINED:

SONORA: Among bushes near a watercourse, Alamos, March or April, 1890, *Palmer* 303 (type collection; G. N). Huehuerachi, altitude 1,220 meters, 1890, *Hartman* 301 (G, N). High up on the Sierra de Alamos, 1910, *Rose, Standley & Russell* 13085 (N).

CHIHUAHUA: Near Batopilas, 1898, *Goldman* 232 (N).

DURANGO: San Ramón, 1906, *Palmer* 68 (G, N).

SINALOA: Arroyo de la Labor, San Ignacio, altitude 380 meters, 1918, *Montes & Salazar* 309 (N).

This very distinct species is quickly recognized by its shrubby habit, densely canescent-pubescent stem and leaves, and large rounded phyllaries.

10 *Tithonia diversifolia* (Hemsl.) A. Gray, Proc. Amer. Acad. 19: 5. 1883.*Mirasolia diversifolia* Hemsl. Biol. Centr. Amer. Bot. 2: 168. pl. 47. 1881.*Urbanisol tagetifolius* var. *diversifolius* Kuntze, Rev. Gen. Pl. 1: 370. 1891.*Urbanisol tagetifolius* var. *diversifolius* f. *grandiflorus* Kuntze, Rev. Gen. Pl. 1: 370. 1891.*Urbanisol tagetifolius* γ *flavus* Kuntze, Rev. Gen. Pl. 1: 371. 1891.*Tithonia speciosa* Klatt, Bull. Soc. Bot. Belg. 31¹: 203. 1891, excluding name-bringing synonym. Not *T. speciosa* Hook. 1866.*Tithonia triloba* Schultz Bip.; Klatt, Bull. Soc. Bot. Belg. 31¹: 203. 1891, as synonym.

Stout branching perennial, or perhaps shrubby, 3 to 9 meters high; stem striate, sparsely hispid-pilose to sordidly pilose-tomentose, in age usually glabrate; leaves alternate, the blades 7 to 20 cm. long, 4 to 18.5 cm. wide, ovate or deltoid-ovate, unlobed or usually 3 to 5-lobed, acuminate to attenuate, at base cuneate, rounded, or subtruncate, then cuneately narrowed into the petiole, crenate-serrate, tripinnate, green but rather densely tuberculate-hispidulous with at length deciduous hairs above, beneath paler green or subcanescent, everywhere, but particularly along the veins, pilosulous or pilose with rather soft hairs and gland-dotted; petioles narrowly margined nearly to base, there biauriculate, 2 to 10 cm. long; heads 6 to 14 cm. wide, on fistulose, striate, sparsely hispid-pilose or subglabrous peduncles 27 cm. long or less; disk 1.5 to 2.3 cm. high, 1.5 to 4 cm. wide; involucre 4-seriate, strongly graduated, 2 cm. high or less, the phyllaries broadly oval, or the outer lance-ovate or oval-ovate, broadly round-tipped or the outer acutish or acute, sparsely appressed-hispid-pilose or subglabrous, the outermost indurate and vittate nearly throughout, with short subherbaceous apex and narrow scarious margin, the innermost with ampliate and elongate submembranaceous apex, all appressed or the inner somewhat loose at apex; rays 12 to 14, golden-yellow, elliptic, tridenticulate, 6 cm. long or less; disk corollas hispidulous below, 7.5 to 8 mm. long (tube 0.5 to 0.8 mm.); pales stiff, abruptly pointed, sparsely hispidulous above, 9 to 11.5 mm. long; achenes appressed-pilose, 4.5 to 5.6 mm. long; awns 2, unequal, 2.8 to 4 mm. long; squamellae 6 to 10, connate below, lacerate at apex, 1.5 to 2.5 mm. long.

TYPE LOCALITY: Valley of Orizaba, Veracruz. The species was based by Hemsley on *Bourgeau* 2319, from the Valley of Orizaba; *Bourgeau* 1562, from the Valley of Córdoba; and plants collected by *Fraser* and *Salvin* at Dueñas, Guatemala. Of these the first is here selected as type.

ILLUSTRATION: Hemsl. Biol. Centr. Amer. Bot. pl. 47.

SPECIMENS EXAMINED:

VERACRUZ: Orizaba, *Botteri* 483 (G). Valley of Orizaba, May 12, 1866, *Bourgeau* 2319 (type collection; G, K, N). Orizaba, altitude 1,220 meters, 1891, *Seaton* 462 (G, N). Valley of Córdoba, 1865, *Bourgeau* 1562 (G, K). Mirador, *Liebmman* 603 (sketch, G). Atoyac, 1882, *Kerber* 161 (N).

MICHOACÁN or GUERRERO: El Ocote, Cerro Pedregoso, 1898, *Langlassé* 528 (G, N).

OAXACA: Sierra de Clavellinas, altitude 2,590 meters, 1894, *Pringle* 5806 (G).

YUCATÁN: Mérida, 1896, *Valdez* 93 (G). Without definite locality, *Gaumer* 944 (N).

GUATEMALA: Cubilquitz, altitude 350 meters, 1902, *Türckheim* 8235 (G, N). Bank of Cahabón River, between Cajval and Chimaste, altitude 200 meters, 1905, *Pittier* 223 (N). Cobán, 1907, *Türckheim* II. 1589 (N). Gualán, 1912, *Mrs. W. P. Cockerell* 50 (N). Guatemala City, 1890, *J. D. Smith* 2371 (G, N). Las Cruces, Department of Santa Rosa, altitude 1,830 meters, *Heyde & Lux* 6166 (G, N). Antigua, 1915, *Holway* 65 (G). San Antonio, 1916, *Holway* 526 (G). San Felipe, 1917, *Holway* 701 (G). Volcán Fuego, 1873, *Salvin & Godman* (K).

SALVADOR: San Salvador, 1905, *Velasco* (J. D. Smith, no. 8868) (G, N). Without definite locality, *Renson* 19 (N).

COSTA RICA: San Vicente, altitude 1,200 meters, 1888, *Cooper* (Pittier & Durand, no. 565; G, N). San José, 1889, *Pittier* 1442 (G); in 1893, *Tonduz* 7140 (G, N). San Francisco de Guadalupe, altitude 1,100 meters, 1895, *Tonduz* (J. D. Smith, no. 7066; G, N). Near Guadalupe, 1892, *Tonduz* 7186 (N).

JAMAICA: Introduced, Hope Grounds, altitude 210 meters, 1915, *Harris* 11877 (G).

CEYLON: *Trimen* (G, K).

BURMA: "A plant which is becoming a pest in Burma," 1912, *Lace* (K).

STRAITS SETTLEMENTS: Singapore, 1861, *T. Anderson* (K); in 1875, *Kuntze* 607A (K).

CULTIVATED: Mount Jackson, Fontabelle, Barbados, 1895, *Waby* 116 (K).

Government House Grounds, Trinidad, 1909, *Broadway* 3605 (K).

Tithonia diversifolia is easily distinguished from the other species of the genus by its large heads, broadly rounded phyllaries, and usually 3-lobed leaves. It is described on some collectors' labels as a shrub, but is more probably an herbaceous perennial. In spite of its widely different characters, it was treated by Otto Kuntze as a variety of *T. rotundifolia* (*Urbanisol tagetifolius* of Kuntze), with several forms of no real consequence.

The species has become somewhat widely spread as a weed in Ceylon and parts of farther India. *Trimen* has noted on a sheet in the Kew Herbarium: "After *Lantana*, the commonest weed in Ceylon. Originally escaped from Peradeniya, where it is called 'Verbesina.'" In his flora of Ceylon, he says:⁴ "*Tithonia diversifolia*, Gray, a native of Mexico and California, though only introduced as a garden plant so recently as 1851, is now one of the commonest and most conspicuous plants in the island, and is generally known as the 'Wild Sunflower.' It doubtless spread from Peradeniya, but is now completely established by roadsides and waste ground over the whole of the moist region up to 5,000 ft., and in places in the dry region also." In Jamaica, *Harris* speaks of it as "introduced but now widely spreading in gardens and as an escape in waste places." In Salvador, according to *Renson* and *Velasco*, it bears the vernacular names "jalacate" and "guasmará."

10a. *Tithonia diversifolia* *glabriuscula* Blake, subsp. nov.

Stem essentially glabrous; leaves less pubescent above, very sparsely puberulous beneath, especially along the veins, and gland-dotted.

Type in the United States National Herbarium, no. 256799, collected north of Tuxtepec, Oaxaca, Mexico, altitude 90 meters, April 9, 1894, by E. W. Nelson (no. 346).

OTHER SPECIMENS EXAMINED:

VERACRUZ: Tlacotalpam, 1894, *Nelson* 496 (N). Without definite locality, 1910, *Orcutt* 3427 (N).

OAXACA: About Santo Domingo, altitude 275 meters, 1895, *Nelson* 2666 (G, N). Tolosa, 1898, *Deam* (G, N).

Intermediates between this and the typical form are represented by *Langlassé* 528, *Gaumer* 944, and *Holway* 526 and 701.

EXCLUDED SPECIES.

TITHONIA ANGUSTIFOLIA Hook. & Arn. Bot. Beechey Voy. 435. 1841.

This is *Viguiera angustifolia* (Hook. & Arn.) Blake.⁵

TITHONIA ARGOPHYLLA D. C. Eaton; S. Wats. in King, Geol. Expl. 40th Par. 5: 423. 1871.

This is *Enceliopsis argophylla* (D. C. Eaton) A. Nels.

⁴ Hand-book Fl. Ceylon 3: 39. 1895.

⁵ Proc. Amer. Acad. 51: 518. 1916.

TITHONIA DECURRENS A. Gray, Mem. Amer. Acad. n. ser. 4: 85. 1849.

This is *Viguiera decurrens* A. Gray.⁶

TITHONIA EXCELSA DC. Prodr. 5: 585. 1836.

This is *Viguiera excelsa* (Willd.) Benth. & Hook.

TITHONIA GLUTINOSA Collie; Hook. & Arn. Bot. Beechey Voy. 33. 1830, as synonym.

This is *Flourensia thurifera* (Molina) DC.

TITHONIA HUMILIS Kuntze, Rev. Gen. Pl. 2: 552. 1891.

This is *Rivina humilis* L., of the family Phytolaccaceae.

"TITHONIA LACINIATA Raeusch. Nom. ed. 3: 251. 1797."

⁶ Proc. Amer. Acad. 19: 5. 1883.

THE IDENTIFICATION OF BERBERIS AQUIFOLIUM AND BERBERIS REPENS.

By CHARLES V. PIPER.

Capt. Meriwether Lewis collected the type specimens of *Berberis aquifolium* and of *Berberis nervosa* at the Great Rapids or Cascades of the Columbia River, April 11, 1806. From these specimens, at least in large part, Pursh described the two species in his *Flora Americae Septentrionalis*,¹ with colored figures of both. The type sheets of both species are now in the possession of the Philadelphia Academy of Natural Sciences, having been secured in some unknown manner from the Lambert Herbarium, where Pursh's types were deposited. There are no duplicates in the set of Lewis's plants left by Pursh at Philadelphia and now at the Philadelphia Academy of Natural Sciences.² In passing it may be stated that these two species with others constitute in the opinion of some botanists a distinct genus, *Mahonia* Nutt. or *Odostemon* Raf., the latter name being the older.

So far as *Berberis nervosa* is concerned little need be said except that the flowers on the type sheet, as also in Pursh's illustration, are those of another species, probably *B. aquifolium*, which fact apparently misled De Candolle to redescribe the plant as *Mahonia glumacea*,³ as first pointed out by Hooker.⁴

Lewis reached the mouth of the Columbia River on November 15, 1805. Later, at the camp at Fort Clatsop, on Young's Bay near Astoria, he had leisure to describe and figure in his journal the common plants of the neighborhood. In his journal⁵ of February 12, 1806, Lewis describes the two species of *Berberis* (*B. aquifolium* and *B. nervosa*) found there as follows:

"February 12, 1806.—There are two species of evergreen shrubs. This is the leaf of one, which I first met with at the grand rapids of the Columbia River, and which I have since found in this neighborhood also; they usually grow in rich dry ground not far from some watercourse. The roots of both species are creeping and celindric. The stem of the first (as above) is from

¹ 1: 219. 1814.

² See Meehan, Proc. Acad. Phila., Jan., 1898.

³ DC. Reg. Veg. Syst. 2: 20. 1821.

⁴ Fl. Bor. Amer. 1: 29. 1829.

⁵ Thwaites, Original journals of the Lewis and Clark expedition 4¹: 62-63.

a foot to 18 inches high and as large as a goose quill; it is simple and erect. Its leaves are cauline and spreading. The leaflets are joined and oppositely pinnate 3 par and termonateing in one, sessile widest at the base and tapering to an acuminate point, an inch and $\frac{1}{2}$ the greatest width, and $3\frac{1}{2}$ inches in length. Each point of their crenate margins armed with a thorn or spine, and are from 13 to 17 in number. They are also veined, glossy, crinated and wrinkled; their points obliquely pointing towards the extremity of the common footstalk.

"The stem of the 2nd is procumbent, about the size of the former, jointed and unbracated. Its leaves are cauline, compound and oppositely pointed; the rib from 14 to 16 inches long and 1 inch wide. The greatest width $\frac{1}{2}$ inch from their base which they are regularly rounded, and from the same point tapering to an acute apex, which is mostly but not entirely termonated with a small subulate thorn. They are jointed and oppositely pointed, consisting of 6 par and termonateing in one (in this form.) sessile, serrate, or like the teeth of a whipsaw, each point terminating in a small subulate spine, being from 25 to 27 in numb; veined, smooth, plane and of a deep green, their points tending obliquely towards the extremity of the rib or common footstalk. I do not know the frute or flower of either. The 1st resembles a plant common to maney parts of the United States called the Mountain Holly."

The drawings of the leaves by Lewis are good and unmistakable and together with the descriptions show clearly that the first of the two species described is *Berberis aquifolium*, the second *B. nervosa*. Clark copies Lewis's descriptions verbatim in his journal of the same date.

Further references to these plants occur in the journals only as follows:

April 2, 1806, when camped on the north bank of the Columbia opposite the mouth of Sandy River:

"and the several evergreen shrubs have ceased to appear except that species which has the leaf with a prickly margin."

April 9, 1806, on the Columbia River above Multnomah Falls, camped that night opposite Brant Island near the foot of the Cascades of the Columbia:

"The vineing honeysuckle has put forth shoots of several inches, the dog-toothed violet is in blume as is also both the species of the mountain holley."

April 12, 1806, camped at foot of Cascades or Grand Rapids:

"Near the river we find the cottonwood, sweet willow, broad leafed ash, a species of maple, the purple haw, a small species of cherry; purple currant, goosberry, red willow, vining and whiteburry, honeysuckle, huckleburry, saca-commis, two species of mountain holley, and common ash."

This is the last mention of "mountain holley" in the journals and written at the place where Lewis collected his specimens. From a study of these notes it is clear that Lewis had not seen either species in fruit, nor was this possible during the period he spent on the lower Columbia.

Pursh's original technical descriptions of the two plants (loc. cit.), to which it will be necessary to refer, are as follows:

2. *B. sarmentosa*, inermis; foliis pinnatis: foliolis sub-3-jugis oblongis repando-dentatis venosis, petalis bidentatis. *Aquifolium*.

B. pinnata. *Herb. Banks*.

On the great rapids of Columbia River, among rocks, in rich vegetable soil. *M. Lewis*. $\frac{1}{2}$. April, May, v.s. *in Herb. Lewis*. Flowers yellow, in large clusters; berries dark purple, eatable; called by Lewis's company *Mountain-holly*.

Caulis fruticosus, laxe ramosus; ramis sarmentosis, procumbentibus. *Folia* sempervirentia alterna, petiolata imparipinnata. *Foliola* 3-juga, opposita, sessilia, impari-petiolata, oblongo-ovata, basi oblique truncata margine cartilaginea repando-dentata, coriacea, utrinque glabra, laevigata, nitida: dentibus aculeatis. *Petioles* teretes, glabri. *Racemi* congesti, bracteati, e gemma precedentis anni. *Flores* aureae. *Bracteae* caduceae, solitariae, subcordatae, acuminatae, membraceae. *Calyx* triplex, deciduus, patens: exterior minimus, 3-phyllus: foliolis ovatis, acutis; medius triplo longior: foliolis suborbiculatis, membranaceis, nervosis; interior longior: foliolis ovalibus, membranaceis, nervosis. *Petala* 6. suberecta, oblonga, apice inciso-bidentata, vix longitudine calycis. *Filamenta* 6. corollae breviora, crassa, medio bidentata: dentibus oppositis. *Antherae* bilobae, crassae. *Germen* superum, ovatum. *Stigma* sessile, 3-lobum. *Bacca* 3-locularis, 3-sperma, abortione interdum monosperma.

3. *B. sarmentosa*, inermis; foliis pinnatis: foliolis 6-jugis ovato-oblongis repando-serratis, sub-5-nervibus, petalis integris. *nervosa*.

In the same situations. v.s. *in Herb. Lewis*.

The specific difference excluded, the description of the preceding species is applicable in every other respect, and together with another in the collection of A. B. Lambert, Esq., collected in Napaul by Mr. Buchanan, forms a new division of the genus, with pinnated leaves; which probably may become a new genus, whenever the fruit is perfectly known, as the statement I have given of it was taken from a single and imperfect berry.

Although Lewis had clearly not seen the fruit of either of the two "mountain holleys" on the lower Columbia River he nevertheless brought back seeds of a species of *Berberis*, from which plants were grown in Philadelphia by McMahon and later introduced into general cultivation. Nuttall took this cultivated plant to be *Berberis aquifolium* Pursh and in his *Genera of North American Plants*^{*} describes it as follows:

^{*} 2: 211. 1818.

307. * MAHONIA.†

Calix 6-leaved, unequal. *Petals* 6. *Nectariferous glands* none. *Filaments* irritable, each filiformly bidentate; *anthers* (as in *Berberis*) growing to the filaments; cells opening by so many vertical elastic valves. *Berry* many-seeded.

SPECIES. 1. *M. Aquifolium*. * * * Flowers sweet-scented, coming out in May (in Mr. McMahon's greenhouse). Cultivated for several years by Mr. McMahon from seeds collected in the Rocky Mountains by the late Governor Lewis.

† In memory of the late Mr. Bernard McMahon, whose ardent attachment to Botany, and successful introduction of useful and ornamental horticulture into the United States, lays claim to public esteem.

After the plant grown by American nurserymen was introduced into England, Lindley described and illustrated it as a new species, *Berberis repens*.⁷ Lindley, who apparently overlooked Nuttall's reference, comments as follows:

A native of north-western part of North America, where it was originally found by the party accompanying Captain Lewis and Clarke in their expedition across the continent of America.

From seeds procured on that occasion plants were raised in America, which have lately been sold into Europe at the rate of twenty-five dollars each. One of these now growing in the Garden of the Horticultural Society afforded our figure and the opportunity of examining the species; it had been purchased of Mr. Michael Floy, Nurseryman at New York, under the name of *Berberis aquifolium*.

It appears, however, from the researches of Mr. Douglas, that this is not the true *Berberis aquifolium*. That species was described by Pursh, in part from an inspection of specimens in the collection of Captain Lewis, but chiefly from the Banksian Herbarium, in which it had been placed by Mr. Menzies, who discovered it on the northwest coast of America. From this last source the drawing in the *Flora Americae Septentrionalis* was also taken. It is probable that the specimens in Captain Lewis's Herbarium were of the plant now under consideration; but it is also certain that those of Mr. Menzies belong to a very distinct species. Hence it seems that Pursh confounded two plants under the same name. That he intended to call Captain Lewis's plant *B. aquifolium*, there can be no doubt; but it is equally certain, that in consequence of his having figured Mr. Menzies' species, the world now applies the name to the latter. This being the case, it has become necessary to distinguish the former by a new name, which has been suggested by its singular property of creeping at the root; a habit peculiar to this species among Berberries."

Lindley's statements have been the prime cause of much of the confusion that has since followed. His statements are certainly unfortunate and probably unwarranted, since it would appear that he had not seen or had not carefully examined the Lewis specimens. This would seem to be implied in the words "It is probable that the specimens in Capt. Lewis's Herbarium were of the plant under consideration," that is, *Berberis repens*. Nor could he have asserted that Pursh's plate was drawn from Menzies' specimens in the Bank-

⁷ Bot. Reg. 14: pl. 1176. 1828.

sian Herbarium, provided such a specimen existed, if he had compared Pursh's plate with Lewis's specimens.

Indeed Lindley's last statement was flatly contradicted in 1831,⁸ where in a discussion of *Mahonia diversifolia*, supposedly from Montevideo, Uruguay, described as a new species, the following appears:

"Two leaflets [*leaves* perhaps intended] of certainly the same species as ours, are preserved in Pursh's Herbarium, now in the collection of A. B. Lambert, Esq. pasted on the same paper with the true *M. aquifolium*, figured by Pursh in his *Flora Americae Septentrionalis*; and one of those [leaflets] is added by the side of his figure. Mr. Lindley's observations on Pursh's *B. aquifolium* are wrong; the very specimen figured by Pursh is now in his Herbarium in Mr. Lambert's collection; the name of *B. repens*, published in the Botanical Register, must therefore be disused."

The writer of this paragraph, apparently Sweet, was clearly acquainted with the Lewis specimen then in the Lambert Herbarium, which he recognized as the basis of Pursh's plate. His statement accusing Lindley of error could scarcely have been made so emphatic unless he felt sure of his ground and of the fact that Lindley had not seen this specimen. It is also apparent from the last clause that Sweet regarded the sheet in the Lambert Herbarium as a mixture of two species, by his referring the two leaves to his *Mahonia diversifolia* and by his implying that the flowering branch is the same thing as *Berberis repens* Lindl.

At my request, Dr. A. B. Rendle has kindly examined the Banksian Herbarium, and writes that he finds there no *Berberis* specimens of Menzies, but does find one labeled "*Berberis pinnata*" collected at Nootka by David Nelson. This is without doubt the specimen referred to by Pursh and besides is the type of "*Mahonia Aquifolium* β *Nutkana*" D.C.⁹ It may be the specimen referred to by Lindley, who may have written "Menzies" inadvertently. Menzies, however, collected both *B. aquifolium* and *B. nervosa*, as the specimens are cited by Hooker.¹⁰ Hooker also cites the Nootka specimen of Nelson under *B. pinnata*. Whether any of Menzies' specimens of *B. aquifolium* were in the Banksian Herbarium when Lindley wrote it is probably impossible to determine. As Pursh consulted with Menzies,¹¹ he perhaps saw Menzies' specimens, though he did not cite them. It may indeed be that some of Pursh's statements in reference to the fruit were supplied by Menzies.

The only Menzies specimens that have been located are those at Kew, upon which Dr. Otto Stapf has kindly reported in much de-

⁸ Sweet, Brit. Fl. Gard. II. 1: under *pl.* 94.

⁹ Reg. Veg. Syst. 2: 20. 1821.

¹⁰ Fl. Bor. Amer. 1: 28-29. 1829.

¹¹ Pursh, Fl. Amer. Sept. xvii. 1814.

tail. The sheet contains four separate specimens, the upper left-hand one in flower, but with only one good blossom; the upper right-hand one in fruit, with only one not quite ripe fruit remaining; the lower left-hand specimen with two deflorate racemes; the lower right-hand one sterile, but with a developed winter bud. The sheet is stamped "Herb. Hooker 1867" (the date of the acquisition of the herbarium), and is labeled in Sir William Hooker's handwriting "Plains of Columbia, A. M. *Berberis acuiifolia*." To this is added in Planchon's hand, "*Mahonia aquifolia* DC. Syst." A question mark has been added after "*aquifolia*" by some unknown person.

In reference to the locality label on the Menzies specimen, it may be pointed out that Menzies did not collect at all on the Columbia River, as he was not with the vessel that explored that river. He could easily, however, have collected the specimens at Nootka or at almost any place along the shores of Puget Sound where he did have opportunity of collecting. As the specimens include both fall and spring gatherings, all could not possibly have come from the Columbia River, since the exploration of this river by Lieutenant Broughton consumed only the interval from October 21 to November 6, 1792. In a recent letter Dr. C. F. Newcombe, of Victoria, B. C., states that there is no mention of *Berberis* in the manuscript of Menzies's journal now in his possession. Dr. Stapf comments as follows:

"There is no doubt whatever in my mind that the Menzies specimens are *Berberis aquifolium* as you understand it and as represented in the photo you sent. Unfortunately, we have no records to show how Menzies's specimens came to be included in William Hooker's herbarium, but we know from the sale catalogue of Lambert's herbarium that the latter contained a set of Menzies's plants and that they were purchased at the sale by William Pamplin, and further that at that time (1842) business relations existed already between Pamplin and Hooker. It is, therefore, very probable that Hooker acquired the Menzies specimens from Pamplin, and that they are actually the set originally included in the Lambertian herbarium. We may consequently assume that Pursh, who used Lambert's collection freely, saw the very specimens of Menzies's collection that are now in the Kew herbarium. If this is so, he may have got his notion of the berries of *B. aquifolium* being dark purple from that specimen, though it does not explain the statement that they are eatable. Where he had it from I do not pretend to know—maybe, as you say, from Menzies himself by word of mouth. It appears to me indisputable that the plant described and figured by Pursh as *B. aquifolium* is the one represented by the specimen collected by Lewis on the 11th April, 1806, and that the name *aquifolium* has to be applied to it. Lindley was no doubt prejudiced by the thought that the seeds which Lewis brought home must be of the same species as he collected and which Pursh used for his description. But as the figure did not tally with Lindley's plant he concluded that Pursh had made a mistake. It is quite clear that Lindley had either not seen Lewis's specimen, or, if he did, looked at it very superficially.

"On the other hand, he knew evidently Menzies's specimen, part of which, the upper left-hand corner, might almost do for Pursh's figure, and comparing it with his new species he might very well say of it that it belongs 'to a very distinct species,' that is, distinct from *his* species.

"I have not seen Nelson's Nutka specimen (*B. pinnata*), but do not think that Lindley could have had it in mind and written 'Menzies' instead of 'Nelson.' Incidentally, I might remark in this place that we have also Menzies's specimen of *B. nervosa* which is cited by Hooker.

"I might finally add that we have a branch of *B. aquifolium* from 'Hort. Lambert.' Lambert had it, therefore, evidently in his collection. There is no date or any other evidence to show when the specimen was taken; it may have been when Pursh was in London, in which case he would have seen it—but why did he not add his 'V. V.'? There are neither flowers nor fruits with it, which, of course, does not exclude that it flowered or fruited. Thus, it is just possible that Pursh not only saw it but saw it in fruit, with 'berries dark purple, eatable.'"

De Candolle¹² had before the publication of *Berberis repens* Lindl. examined the Nelson specimen in the herbarium of Banks, and apparently also the Lewis specimen in the Lambert Harbarium. The former he regarded as perhaps specifically different, but described it as *Mahonia aquifolium* β *nutchana*. In his description of *M. aquifolium* he quotes partly from Pursh and partly from Nuttall. It will be recalled that Nuttall's description was based wholly on plants cultivated by McMahan from the seeds brought back by Lewis, that is, the plant later named *Berberis repens* Lindl. Perhaps this confusion in the descriptions, rather than the Lewis specimen, may have influenced De Candolle to consider the Nutka plant distinct.

Torrey and Gray¹³ were strongly influenced by Lindley's statements, though they were aware of Sweet's contradiction above quoted. They included both the shiny-leaved and the glaucous-leaved plants as varieties of one species. In reference to the glaucous-leaved plant they write: "The former [i. e., *B. repens* Lindl.] is moreover the plant originally brought to the United States by Lewis, and described and figured (chiefly) by Pursh, and cultivated in gardens under the name *Berberis aquifolium*; so that it ought, in accordance with the rule in such case, to remain the original name." In a footnote these authors also write as follows: "The separate leaflets attached to Pursh's specimen in herb. Lambert, one of which is figured in his plate, are said in Brit. fl. gard., under *Mahonia diversifolia*, t. 94, to belong to that species. There is little doubt, however, that they were taken from the specimen of Menzies in herb. Banks."

In reference to Torrey and Gray's treatment of the two plants, Lindley comments¹⁴ as follows: "People in this country will be sur-

¹² Reg. Veg. Syst. 2: 20. 1821.

¹⁴ Bot. Reg. 25: 5. 1839.

¹³ Fl. N. Amer. 1: 50. 1838.

prised to find that our American friends suppose *Berberis repens* to be a variety of *B. aquifolium*."

Torrey and Gray's conclusions as to the identity of *Berberis aquifolium* Pursh and *B. repens* Lindl. were later adopted by Watson¹⁵ and by Brewer and Watson.¹⁶

On these grounds Rydberg¹⁷ considers that the name *Berberis aquifolium* Pursh really belongs with the glaucous-leaved species occurring in Montana, that is, *B. repens* Lindl., and comments as follows:

"It is evident that Pursh's description and plate, except one leaflet, belong to what has generally been known as *B. repens* Lindl. Lindley made a mistake when he supposed that the name *B. aquifolium* belonged to the tall shrub of the Pacific coast, and this mistake has been followed by most American authors."

Kearney¹⁸ had several years before reached the conclusion that "it was to the low plant of the Plains and Rockies, not to the tall shrub of the Pacific slope, that Pursh applied this name," i. e., *Berberis aquifolium*, and he therefore renamed the shiny-leaved shrub *Berberis nutkana* (DC.) Kearney.

Greene,¹⁹ in proposing the name *Berberis nana* for the Rocky Mountain plant, considered it different from *B. repens* Lindl., but retained the name *B. aquifolium* Pursh for the shiny-leaved plant of the Pacific northwest.

Upon request, Dr. B. L. Robinson, of the Gray Herbarium, has searched for such records as Dr. Gray may have made of the Pursh specimens, and he reports as follows:

"In Life and Letters of Dr. Gray, Vol. I, p. 22, under date of 1839 of his autobiography, Dr. Gray says: 'Old Lambert, too; he had the Hookers and myself at dinner, and gave me as good opportunity as he could to consult the Pursh plants, etc., in his herbarium, which, not long after, was scattered, but it was in his dining room, which was very much lumbered, and to be reached only at certain hours.'

"The original of Dr. Gray's autobiography, in his own handwriting, is in the Gray Herbarium, where this quotation has been verified.

"In a letter of Dr. Gray dated February 1, 1839, he says: 'I spent the earliest part of the morning in my own room, then went to Lambert's and commenced the examination of Pursh's plants.' In his manuscript notes on Pursh's herbarium he says:

"*'Mahonia Aquifol. β Nutkana DC. Menzies is from a form approaching Lindley's B. repens. Pursh could not have taken his separate leaf from this—but doubtless from the other specm. in herb. Lamb. on the same sheet—for which see Don in Brit. fl. Gard.'*

"In Sweet's British Flower Garden, new ser., Vol. II, 1833, under plate 171, which is dated December, 1832, this comment on *Berberis nervosa* D. Don is

¹⁵ In King, Geol. Expl. 40th Par. 5: 13. 1871.

¹⁶ Bot. Calif. 1: 14. 1876.

¹⁷ Mem. N. Y. Bot. Gard. 1: 170. 1900.

¹⁸ Trans. N. Y. Acad. Sci. 14: 29. 1894.

¹⁹ Pittonia 3: 98. 1896.

given: 'Pursh having erroneously added the flowers of *B. aquifolium* to his plate of *nervosa*, misled De Candolle, who has reproduced the species under the name of *glumacea*.' "

Dr. Gray evidently refers to the Menzies specimen then in the Lambert Herbarium now at Kew. The comment in the British Flower Garden quoted above is seemingly not the reference Dr. Gray intended, and it can scarcely be the remarks of Sweet previously quoted.

Inasmuch as the first part of Torrey and Gray's Flora of North America containing their treatment of *Berberis* was published in 1838, these notes of Dr. Gray could have had nothing to do with the conclusions reached by them at that time.

In Dr. Gray's last publication on the subject²⁰ he writes under *Berberis aquifolium* Pursh, "Fl. 1: 219, in part and t. 4, mainly," while under *Berberis repens* Lindl. he states, "*B. aquifolium* Pursh, l. c. 219, mainly as to descr." This apparently means that Pursh's plate is mainly the shiny-leaved tall plant and his description mainly the dull-leaved low plant, but the basis for these conclusions does not appear.

The fundamental error of Lindley, as likewise of Nuttall before him and of later authors who have followed them, lies in the assumption that the seeds brought back by Lewis were of the same plant of which he collected specimens in flower at the Great Rapids of the Columbia. When Lewis was at the mouth of the Columbia he expressly notes that he had not seen either the flowers or fruit of the "mountain holley." He recrossed the Bitter Root Mountains in the latter part of June, 1806, far too early to have secured ripe fruit in the neighborhood of Kamiah and Weippe, Idaho, where he had been during most of June. It is apparently certain, therefore, that he secured the seeds he brought back east of the Bitter Root Mountains and most probably in Montana. Nuttall says "Rocky Mountains," but in Lewis's journal no record of the collecting of these seeds has been found. It is certain that he could not have gotten the seeds at the Great Rapids, where he collected the types of *B. aquifolium* and *B. nervosa* in flower.

This brings us to the question as to whether the type of *B. aquifolium* Pursh, collected at the Great Rapids, is the same species as *B. repens* Lindl., grown from seed collected by Lewis probably in Montana, where only this latter species occurs.

The writer has previously expressed the opinion²¹ that this could not be the case, as the glaucous-leaved species, *B. repens*, was not known to occur so far down the Columbia River as the Cascades.

²⁰ Syn. Fl. 1: 69-70. 1895.

²¹ Contr. U. S. Nat. Herb. 11: 282. 1906.

In September, 1916, the writer collected abundant material of the species of *Berberis* occurring at the Cascades or Great Rapids of the Columbia River. The original spot, where Lewis almost certainly collected his specimens, is now occupied by the Cascade Locks, but on the bench above, lying about 30 meters higher and one-fourth mile distant, *Berberis* is abundant. In this place two distinct species of *Berberis* are found: *B. nervosa*, abundant in underbrush; *B. aquifolium*, with shiny leaves, abundant in shady places, and to a less extent in the open; and in addition in very open places and much scarcer occurs a somewhat dull or glaucous-leaved plant, which closely simulates *B. repens* Lindl. However, there are very numerous intermediates between the shiny-leaved species and the glaucous-leaved plant. The latter was at first taken to be *B. repens* Lindl., but microscopic characters hereafter discussed, as well as the form of the leaflets, point to its being a dull-leaved form of *B. aquifolium* Pursh. Specimens of *B. aquifolium* and *B. repens* are usually at once distinguishable by the tall habit of the former and the low habit of the latter. No great stress can be put upon the character of creeping branches, which Lewis had mentioned in his notes on *B. nervosa* and *B. aquifolium*, as they occur at the mouth of the Columbia. This character was mentioned by Pursh in his description of *B. aquifolium*, in which species it often occurs, as was especially observed at the type locality; but creeping branches are far more developed in *B. repens*. Very careful comparisons of the details of the flowers and seeds failed to disclose any characters that could be regarded as crucial. The leaflet characters of form and dentition suffice to separate the two species in the great majority of cases, but occasional specimens occur in which these characters are insufficient. The best distinguishing characters are those of the leaf surface. The leaflets of *B. aquifolium* are nearly always shiny above, but occasionally dull, and beneath pale green, but never glaucous; while those of *B. repens* are nearly always dull on the upper surface and glaucous beneath. In ambiguous specimens the under surface of the leaflets when examined under a binocular supplies a critical difference to separate the two species, as first clearly indicated by Dr. Otto Stapf.

In reference to the characters exhibited by the under surface of the leaves, Dr. Stapf writes as follows, October 30, 1919:

"I have compared the anatomical structure of the lower epidermis of the leaves of *B. Aquifolium* and *B. repens*, and the other North American Mahonias immediately allied to them, and have come to the conclusion that the characters of the presence or absence of papillae is indeed a very great help in discriminating otherwise doubtful specimens. If they hybridize we might of course expect intermediate forms, but among the Kew material I have found none."

In 1916 Dr. Albert Mann made a careful microscopic examination of the leaves of three variants of *B. aquifolium* from the type locality. The dull-leaved form was then supposed to be *B. repens* and the plant is thus named in his report, which is as follows:

"A microscopical examination of the leaves of *Berberis repens* and *B. aquifolium* gives no satisfactory distinctions on which one could base a claim for difference of species. Transverse sections of these leaves, made at the same place in the lamina, show that *aquifolium* has the same number of rows of palisade cells as *repens*, but the cells are smaller and consequently there are more in number in a given area; the spongy parenchym is not so loose, and has thicker walls; the cuticle, especially of the upper epidermis, is thicker. This difference could readily be accounted for by a difference of habitat, as these characteristics are strongly influenced by light, and especially by a minimum quantity of moisture.

"A comparison of the epidermal surfaces torn from the leaf shows more marked distinctions, but hardly justifying a specific separation. The upper epiderm of *aquifolium* consists of smaller cells than that of *repens*, far less serpentine in outline, quite thick, and abundantly cut across by canaliculi; those of *repens* quite sinuous, thinner, and only slightly, if at all, perforated. The under epiderms contrast even more strongly. The stomata of *aquifolium* are more abundant and with larger guard-cells, with occasionally lenticels on the surface, the other cells of the epiderm being considerably smaller—from two to four times—than those of the stomata. The cells of *repens* are from one to one-half the size of the stomata, and the walls are, as in the upper epiderm, very much thinner.

"I do not see how any specific distinction can be drawn from these contrasts, as I am not at all sure that if the habitats of the two plants were exchanged, the differences noted by me would not be reversed and almost as marked as above recorded.

"There is a striking difference in the coloration of the leaves, which results in the stomata of *aquifolium* standing out from the rest of the epiderm as deep brown chlorophyll-containing cells; but this is doubtless due in part to the greater age of the specimen of this species."

Since the receipt of Dr. Stapf's letter, numerous specimens have been examined to test the value of the character that he points out, and it seems that in all critical cases it furnishes a definite basis of determination. The lower epidermal cells in both species project on their free surfaces as low papillae. In *B. repens* these papillae, as viewed vertically, are small, circular, prominent, and distinctly separated; in *B. aquifolium* they are lower, larger, and contiguous, thus assuming almost exactly the cell outline. A reexamination of Pursh's type specimen on the basis of this distinction alone, places it definitely with the shiny-leaved species.

On the basis of the specimens examined, *Berberis aquifolium* ranges from Vancouver Island and southern British Columbia southward to the Callipooia Mountains of Oregon and eastward to western Idaho. The only other species in which the lower epidermis has a similar structure is *Berberis pinnata* Lag., of the coast region of

California. No specimens from California representing true *B. aquifolium* have been seen.

Berberis repens ranges from the Cascade Mountains eastward to the Black Hills of South Dakota and from about the 55th parallel of latitude southward to New Mexico and California. In Arizona and California particularly occur divergent forms or perhaps distinct species, such as *B. pumila* Greene, *B. dictyota* Jepson, and *B. wilcoxii* Britt. & Kearney. All these exhibit the same papillate character in the under epidermis of the leaf as does *B. repens*. The relationship of these forms is not here especially considered, but a few words need to be said about a peculiar plant of southwestern Oregon and northern California which in habit, stature, and its somewhat shiny leaves resembles *B. aquifolium*. From that species it is at once separated by the under surface of the leaves, which is covered with a rather dense, somewhat ferruginous bloom that under the binocular shows a papillate appearance quite like that of *B. repens*, *B. pumila*, and *B. dictyota*. The leaves are reticulate less strongly than those of *B. dictyota* and *B. pumila*. For the present it seems best to associate this plant with *B. dictyota*. The larger thinner leaves may well be the result of less arid conditions. The specimens referred to include the following:

OREGON: Gold Hill, Walpole 146, March 25, 1899. Cascade Mountains, Austin 1467, August 20, 1897. Black Mountain near Keno, Applegate 2007, May 8, 1898. Wimer, Hammond 13, April 30, 1892. Four Mile Creek, Klamath County, Coville & Applegate 272, July 29, 1897. Grizzly Peak near Medford, Leiberg 4139, June 22, 1899.

CALIFORNIA: Yreka Creek, Butler 1807, August 1, 1910; Butler 1169, April 11, 1910. Truckee, Sonne 11, April, 1885.

The original specimens of Lewis, which must be considered the types of *Berberis aquifolium* Pursh, are illustrated in Plates 24 and 25. The specimens are sewed to the sheet with olive-green silk thread in a uniform manner. The two large leaves are darker in color and a trifle more shiny than the rest of the specimens. On the back of the sheet appears in Pursh's handwriting, "N. American Herb. Lewis & Clark. Fred. Pursh." There is no inherent reason why all the specimens on the sheet may not have been collected by Lewis at "Great Rapids," as all of them can be matched perfectly by material collected at the type locality. The two larger leaves are typical of the shiny-leaved plant growing in copses in partial shade. The leaf of the flowering branch is likewise matched by that of a fruiting specimen growing in the open, which from both its tallness and its shiny leaves is the same species as the more shiny-leaved plant of the copses.

By comparing Pursh's illustration (Plate 26) with the type specimen (Plates 24 and 25), it is clear that the large figure is drawn

from the left-hand specimen on the type sheet, but with some minor errors as regards the small leaf below the inflorescence. It seems highly probable that the separate leaflet of the plate was drawn from the one missing on the lower leaf of the type specimen. In form and dentition it agrees extremely closely with its probable mate still on the specimen, so closely indeed as to suggest that it may be the same reversed and drawn to show the underside. Dr. Gray apparently reached essentially the same conclusion when he wrote, "Pursh could not have taken his separate leaflet from this—but doubtless from the other specm. in herb. Lamb. on the same sheet." The very close similarity of Lewis' specimen and Pursh's plate should be convincing that Lindley was in error when he asserted that Pursh's illustration was drawn wholly from Menzies' specimens in the Banksian Herbarium. This is also supported by the criticism in *British Flower Garden*,²² previously quoted. It is a remote possibility that the two complete leaves on Pursh's type sheet are from some other collection than Lewis's, but such an assumption in the lack of evidence is gratuitous.

It further may be again mentioned that it is extremely doubtful if there ever was a Menzies specimen in the Banksian Herbarium, so that Lindley apparently meant either the Nelson specimen in the Banksian Herbarium or the Menzies specimen in the Lambert Herbarium.

In Pursh's original description of the two species occur some statements which still remain questionable. These descriptions need to be considered in the light of the following paragraphs from the preface of his book.

"The descriptions of those plants, as far as the specimens were perfect, I have inserted in the present work in their respective places, distinguishing them by the words *v. s. in Herb. Lewis*. Several of them I have had an opportunity of examining in their living state, some being cultivated from seeds procured by Mr. Lewis, and others since my arrival in England from seeds and plants introduced by Mr. Nuttall." (p. xi.)

"Perfect seeds from the last-mentioned tree [Osage apple] were given by Lewis to Mr. McMahon, nursery and seedsman, at Philadelphia, who raised several fine plants from them, and in whose possession they were when I left America." (p. xii.)

"Besides these general collections, there were a number of interesting new plants in the Banksian Herbarium collected by different persons in North America. Among them I found a number of those collected by Archibald Menzies, Esq., during the famous expedition under Vancouver, on the north-west coast of America. As several of them had been described by me from the Lewisian collection, I requested permission of Mr. Menzies to adopt such as were immediately connected with my plan, which he very obligingly complied with. (p. xvii.)

²² II. 1: under *pl.* 94.

"After the usual sign of duration, and the time of flowering, each species has been faithfully marked whether I have seen it myself in a living state (*v. v.*), or only in a dried specimen (*v. s.*); in the latter case the name of the herbarium I had it from is generally mentioned. Those I have adopted without seeing them myself in either state, and which are but few, I have marked (+)." (p. xxi.)

In the descriptions of the two species the symbol "*v. v.*" does not occur with either, yet in that of *Berberis aquifolium* Pursh says, "berries dark purple, eatable," and "*Bacca* 3-locularis, 3-sperma, abortione interdum monosperma." The last phrase is apparently explained in the note under *B. nervosa*, where Pursh says that "the statement I have given of it was taken from a single and imperfect berry." This statement is that above quoted, as in the description of *B. nervosa* only the leaves are described, with the explanation, "The specific difference excluded, the description of the preceding species [*i. e.* *B. aquifolium*] is applicable in every other respect." The description of the fruit may have been taken from Menzies' specimen or more likely from the Nepaul species collected by Buchanan and referred to by Pursh in the note under *B. nervosa*. The origin of the information "berries dark-purple, eatable" is wholly obscure.

On the basis of the series of specimens collected at the Great Rapids and a reexamination of the type specimen, the writer believes that all of the type sheet was in reality collected by Lewis and that it all represents the shiny-leaved species. The flowering shoot has leaves less lucid than usual, but certainly too shiny to associate it with typical *Berberis repens* Lindl.

There seems no other basis than Lindley's statement, already discussed, that Pursh's plate was drawn from a specimen of Menzies. Lindley labored under the idea that Lewis's Great Rapids specimen was the same at least in part as that of which he brought back seeds, the progeny of which seed was the basis of *Berberis repens* Lindl. Lindley in all probability had not seen Pursh's type. The conclusions of Torrey and Gray are largely based on Lindley's statements, as it is not clear that either of these botanists had examined Pursh's type specimen before the time they published their comments; indeed they quote "ex Lindl."

In the light of the data presented above, the specific name *aquifolium* should be retained for the shiny-leaved, usually tall species of the northwest coast, which extends into the interior of Washington as far as Spokane, while the name *repens* should remain associated with the smaller plant of Montana, which in various forms ranges over much of the area east of the Cascade Mountains from British Columbia and Montana to California and New Mexico. A very extensive bibliography of these *Berberis* species up to 1878 may be found in Watson's Bibliographical Index (pp. 34-35).

EXPLANATION OF PLATE 24.—Photograph (reduced) of the type specimen of *Berberis aquifolium* Pursh, now in the herbarium of the Philadelphia Academy of Natural Sciences. From the labels it is clear that Pursh originally intended to publish the plant as a new genus. The principal label in Pursh's handwriting reads as follows: "————— *ilicifolia*, Nov. genus. Mountain Holly. The flowering stem springs up from near the ground and is upright; the infertile shoots trail along the ground. Rich soil among rocks. Great rapids of Columbia. April 11, 1806. Capt. Lewis."

The unpublished genus name of Pursh is omitted and it has also been obliterated from the plate, to avoid bringing additional synonymy into the literature of the subject.

EXPLANATION OF PLATE 25.—A portion of the type specimen of *Berberis aquifolium* Pursh, shown in Plate 24. Natural size.

EXPLANATION OF PLATE 26.—Photograph of Pursh's colored plate of *Berberis aquifolium*. It is clearly evident that the flowering shoot was drawn from the Lewis specimen. The separate leaflet probably depicts the missing leaflet of the lower leaf of the Lewis specimen. The three-lobed stigma on the fruit is erroneous.

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[Synonyms in italic.]

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BERBERIS AQUIFOLIUM PURSH.



BERBERIS AQUIFOLIUM PURSH.



BERBERIS AQUIFOLIUM PURSH.

NEW OR NOTEWORTHY PLANTS FROM COLOMBIA AND CENTRAL AMERICA—8.¹

BY HENRY PITTIER.

INTRODUCTION.

Another installment is here offered of results obtained by the writer in his study of the botany of Middle America. As in previous papers, the groups dealt with are largely trees, which, from the difficulty of securing adequate herbarium material, have been greatly neglected and misunderstood.

MYRISTICACEAE.

***Virola merendonis* Pittier, sp. nov.**

A large tree, up to 25 meters high, the trunk straight, the branching radiate, forming a short depressed conical crown; bark grayish, smooth; young branchlets and leaf buds densely rufous-tomentose.

Leaves large, petiolate, subcoriaceous; petioles 1 cm. long, about 4 mm. thick, densely rufous-tomentose, the upper groove bordered on each side by a narrow wing running from the stem to the base of the blade; leaf blades oblong-lanceolate, truncate and usually emarginate at the base, gradually attenuate and very acute or seldom rounded-obtuse at the apex, 18 to 25 cm. long, 7 to 8 cm. broad, minutely reticulate above and glabrous except on the costa, softly tawny-tomentose beneath, the costa subimpressed and hairy on the upper face of the leaf, very prominent and reddish-hairy beneath, the veins 20 to 25 pairs, impressed above, prominent and reddish-hairy on the lower face, arcuate and distinctly confluent along the margin, the transverse venules hardly visible on either side, but more so beneath. Flowers not known.

Fruiting racemes about 6 cm. long, bearing 2 to 6 fruits; pedicels 7 to 10 mm. long; fruit subglobose, about 2 cm. long and 1.7 cm. in diameter, at first rufous-furfurascent, later glabrous.

Type in the U. S. National Herbarium, no. 1,012,334, collected in the forests of Cuchillitas, between Arranca Barba Hills and Mohanes, in the Cordillera de Merendon, borders of Guatemala and Honduras, in fruit, May 18, 1919, by H. Pittier (no. 8530).

Another collection was made in the Molha Valley in the same region, on the same date, by Whitford and Stadtmiller (no. 12).

It is not without hesitation that a new species is based upon the incomplete specimens at hand. There are, however, three species of *Virola* described from Central America, *V. guatemalensis* (Benth.) Warb., *V. panamensis* (Benth.) Warb., and *V. warburgii* Pittier, none of which compares satisfactorily in the

¹No. 7 of this series was published as Part 3 of the present volume (pp. 95-132, pl. 7).

characters of the leaf with the newly collected plant. In *V. guatemalensis* there are, it is true, 15 to 30 primary veins, but these are not distinctly confluent along the margin, and, besides, the blades are cuneate and not truncate-emarginate at the base, and obtuse and not very acute at the apex; they are also said to be glabrate and pellucid-punctate, with petioles about half shorter. From *V. panamensis* and *V. warburgii* the newly discovered tree differs in the greater number of veins, so that a further comparison is hardly necessary. There may be a great variation in the shape of the leaves in *V. guatemalensis*, to which the specimens here described may then be added, but this can be decided only after the flowers of both forms are known.

Compsonura sprucei (A. DC.) Warb. Nov. Act. Acad. Caes. Leop. Carol. 68: 143. 1897.

Myristica sprucei A. DC. in DC. Prodr. 14: 199. 1856.

Myristica mexicana Hemsl. Biol. Centr. Amer. Bot. 3: 67. pl. 73. 1882.

Warburg has commented on the remarkable identity of specimens growing as far apart as Mexico and the Amazon Valley. Although I also consider it probable that the examination of adequate material from both areas may result in the recognition of a distinct Middle American type, for which the name *Myristica mexicana* Hemsl. is available, attention may be called to the fact that other plants, such as *Dialium divaricatum*, *Tecoma pentaphylla*, and *Calophyllum calaba*, have quite as wide a distribution. These are better known on account of having some economic application, while the former, not being of any specific use to man, has been more or less ignored. In fact, it may be found to be widely dispersed between the two extreme points from which it has been reported.

The fruit and seed have been lacking in all described specimens. A description of these follows:

Pedicels 8 to 15 mm. long, glabrous, bearing at about the middle the persistent perigonium; fruit ovoid, 3 cm. long, 2.3 cm. in diameter, the pericarp dehiscent, bivalvate, thin, glabrous; seed ovoid, 2.6 cm. long, 1.7 cm. in diameter, completely surrounded by a membrane-like yellow aril; exosperm finely ruminate; embryo very small, ruminate.

The fruiting specimens from which the description is drawn were collected by Whitford and Stadtmiller on the trail from Los Amates, Guatemala, to La Florida, Honduras, in May, 1919. I find also in the National Herbarium the following specimens:

MEXICO: Atasta, Tabasco, in shaded places, flowers, June 30, 1889, *Rovirosa* 517.

HONDURAS: San Pedro Sula, Department of Santa Barbara, flowers, September, 1888, *Thieme* (J. D. Smith, no. 5256).

Dialyanthera latialata Pittler, sp. nov.

A tree, 8 to 15 meters high, the trunk straight, the branchlets glabrate.

Leaves large, alternate, membranous, entirely glabrous, congested at the ends of the branchlets, the petioles 1 to 2.5 cm. long, broadly alate through the decurrence of the blade, this broadly obovate, long-attenuate toward the base, short-acuminate at the apex, 20 to 30 cm. long, 9 to 10 cm. broad, dark green above, brownish-glaucous beneath, the costa and primary veins impressed above, the former very prominent and stout, the latter 20 to 25, slender, slightly arcuate, anastomosing along the margin of the blade. Staminate inflorescences axillary or on defoliate nodes, up to 20 cm. long, the main rachis usually ternate, glabrous, the flowers ebracteate, brownish yellow, in opposite sessile clusters; pedicels slender, 7 to 11.5 mm. long; perianth about 3 mm. long, 3-fid,

the lobes oblong to ovate, obtuse, 2 mm. long, at first erect, later reflexed; stamen column 1.5 mm. long, thicker at the base; anthers 3, ovate, 0.3 mm. long, subconnate. Pistillate inflorescence and fruit not known.

Type in the U. S. National Herbarium, no. 679296, collected in forests along the Fató River above Nombre de Dios, Caribbean coast of Panama, in flower (male only), August 16, 1911, by H. Pittier (no. 4193).

Of the two known species of *Dialyanthera*, *D. otoba* (H. B. K.) Warb. has leaves with only 9 to 15 primary veins, and almost wingless petioles, inflorescences with alternate flower clusters, and floral pedicels hardly longer than the perianth; *D. gordoniiifolia* (A. DC.) Warb. has 15 to 20 primary veins and narrowly winged or subalate petioles, alternate flower clusters, and pedicels shorter than the flowers. These characters are sufficient to show that the species just described, in which the leaves have from 20 to 25 primary veins and broadly winged petioles, the flower clusters are opposite, and the pedicels are several times longer than the perianth, is a very distinct type.

Warburg refers to an unknown species of *Dialyanthera* from Chiriquí, Panama, represented by fruits in the museum at Munich, which may belong to this species. However, a fourth species is known from the rain forests of Costa Rica; it has been identified by John Donnell Smith as *D. otoba*, but I consider this determination doubtful. In the Costa Rican tree the branchlets are pubescent, not glabrous, the petioles are 2 cm. long or more and distinctly but narrowly winged; the blades are quite opaque and not pellucid-punctate, and acute rather than abruptly acuminate; and the inflorescences are usually geminate in the axils. A decision should be reserved, however, until we have the necessary material for comparison.

MIMOSACEAE.

THE SPICATE-FLOWERED SPECIES OF *PITHECOLLOBIUM* OF THE *UNGUIS-CATI* SECTION.

INTRODUCTION.

The spicate-flowered species of *Pithecollobium* of the *Unguis-cati* section include four groups, represented, respectively, by *P. pachypus*, *P. hymenaeaefolium*, *P. ligustrinum*, and *P. oblongum*. This last group contains forms with very short spikes, indicating a transition to the globose-flowered species of the same section.

Pithecollobium pachypus is distinguished mainly by its relatively enormous pods, these thick and short, with the few seeds large in proportion. It has been collected only once, in El Salvador, and seems to represent a peculiar type without close relatives.

The pods of the 12 remaining species are usually long, terete, and more or less curved, very rarely short but then flat; that is, they are of the type characteristic of the section. *P. hymenaeaefolium* and *P. ligustrinum* differ from *P. oblongum* in having a sessile ovary, flower spikes scattered along the branchlets, and an almost always exerted stamen tube. In the group of *P. oblongum* the ovary is stipitate and the spikes are borne on special axillary branchlets forming true panicles, and the stamen tube is always inclosed.

These differences are fundamental, and sufficient to characterize the groups.

Pithecollobium hymenaeaefolium is distinguished from *P. ligustrinum* by its large flowers, each with a strikingly developed stamen tube. *P. macrostachyum*, an imperfectly known species, is, according to description, a closely similar if not identical form. In the group of *P. ligustrinum*, with six easily distinguishable species or subspecies, the species are separated primarily by the size and nature of the stipules, the shape of the bractlets, the presence or absence of indument on the ovary, and other characters which seem to be very constant.

With the well-characterized group of *P. oblongum* an approach is made to the globose-flowered species of *Pithecollobium* of the same section. This group presents two almost parallel series, differentiated by a single but apparently constant character, the length of the ovary stipe. In each group we have two species, the one with stipitate petiolar glands, the other with sessile glands. The number of flowers in each spike is much reduced in the last two species of the series, the more so in *P. subglobosum*, which might be placed among either the *Spicatae* or the *Globosae* but for their possession of characters showing their affinity with *P. oblongum*.

KEY TO SPECIES.

- Legume short, terete, and very thick, the valves about 2 cm. broad. Petioles very short; calyx and corolla grayish-hairy----- 1. *P. pachypus*.
 Legume rather long and slender, sometimes flat, the valves narrow.
 Ovary sessile; spikes usually single in the axils; stamen tube usually exserted.
 Corolla 8.5 mm. long or more; stamen tube very long-exserted.
 Stamen tube seldom over 2.5 cm. long; corolla 12 to 13 mm. long; leaflets ovate-lanceolate, up to 13 cm. long-- 2. *P. hymenaeaefolium*.
 Stamen tube up to 3.8 cm. long; corolla 8.5 to 11 mm. long; leaflets ovate-oblong, up to 8 cm. long-----3. *P. macrostachyum*.
 Corolla 7 mm. long or less; stamen tube moderately exserted.
 Stipules spinulose or obsolete; ovary glabrous----- 4. *P. spinulosum*.
 Stipules spinescent, strong, rarely obsolete; ovary pubescent or hairy.
 Bractlets lance-subulate, subpersistent, often as long as the calyx.
 Corolla 6 to 7 mm. long; stamen sheath exserted about 2 mm.
 5. *P. insigne*.
 Corolla 5 to 6 mm. long; stamen sheath exserted about 5 mm.
 6. *P. calostachys*.
 Bractlets small, scalelike, much shorter than the calyx.
 Calyx 1 to 1.2 mm. long----- 7. *P. macrosiphon*.
 Calyx 2 to 3 mm. long.
 Stipular spines long (up to 2 cm.); interpetiolar stipules subulate; corolla minutely pubescent-----8. *P. lanceolatum*.
 Stipular spines short (seldom over 0.5 cm.); interpetiolar stipules acute-triangular and very short; corolla conspicuously silky-pubescent ----- 9. *P. ligustrinum*.

Ovary distinctly stipitate; spikes in axillary panicles; stamen tube almost always included.

Stipe of the ovary not over 1 mm. long. Ovary glabrous.

Petiolar glands sessile or substipitate; inflorescences stout, grayish-hairy; leaflets pilosulous all over----- 10. *P. paniculatum*.

Petiolar glands distinctly stipitate; inflorescences slender, glabrous or villosulous; leaflets glabrous except at the barbate base.

11. *P. pulchellum*.

Stipe of the ovary 2 mm. long or over.

Leaflets oblong or obovate, up to 5 cm. long, usually narrow and obtuse at the apex; glands sessile; ovary hairy----- 12. *P. oblongum*.

Leaflets not over 2 cm. long, broadly ovate, usually emarginate at the apex; glands stipitate; ovary glabrous----- 13. *P. subglobosum*.

DESCRIPTION OF SPECIES.

1. *Pithecollobium pachypus* Pittier, sp. nov.

A small tree, the bark brownish gray, minutely lenticellate on the younger branchlets, these glabrous or glabrescent and stiff.

Leaves bipinnate, coriaceous, the basal stipules spinescent, straight, slender, acute, up to 5 mm. long; petioles canaliculate, more or less hairy in the deep recesses, the main petiole 0.5 to 1 cm. long, with a discoid sessile apical gland; pinnae unijugate, the interpetiolar stipules triangular-acute, very short, hairy, caducous, the secondary petioles 4 to 6 mm. long, the apical gland small and often obsolete; leaflets unijugate, sessile, oblique-ovate, obtuse and often emarginate at the apex, barbate at the base on the inner half, 2.5 to 5 cm. long, 1.5 to 3 cm. broad, the venation very prominent on the upper side, less so on the lower side.

Racemes axillary, subpaniculate at the ends of the branchlets, the rachis 4.5 to 7 cm. long, grayish-hairy; bracts up to 6 mm. long, hairy, formed by a residual petiole with the apical gland and ending with the reduced interpetiolar stipule; bractlets linear-subulate, very small, hairy; flowers white, densely grayish-hairy, 15 mm. long; calyx tubular, 3 mm. long; corolla 5 to 6 mm. long; stamen tube exerted; pistil 15 mm. long, glabrous.

Legume dehiscent, 6 to 8 cm. long, about 1.5 cm. in diameter, 2 to 4-seeded, the valves 2 cm. broad; seeds ovoid-depressed, up to 2 cm. broad, brown and lustrous.

Type in the U. S. National Herbarium, no 399510, collected in the vicinity of San Salvador, El Salvador, in 1905, by Carlos Renson (no. 218).

Clearly related to *P. ligustrinum* (Jacq.) Klotzsch, but differing by its short petioles, the hairiness of the calyx and corolla, and, above all, by the short, uncommonly thick pods. It is known locally under the name of "abracade."

2. *Pithecollobium hymenaeaefolium* (Humb. & Bonpl.) Benth. Lond. Journ. Bot. 3:198. 1844.

Inga hymenaeaefolia Humb. & Bonpl.; Willd. Sp. Pl. 4:1008. 1806.

Mimosa hymenaeaefolia Poir. in Lam. Encycl. Suppl. 1:38. 1810.

Pithecollobium panamense Walp. & Duchass. Linnaea 23:746. 1850.

A shrub or a small tree, up to 4 meters high, the bark of the branchlets grayish, smooth, glabrous.

Leaves bipinnate, glabrous, the stipules spinescent, strong, more or less arcuate, up to about 1 cm. long; petioles stout, canaliculate, the main one 1 to 3.5 cm. long, with a large sessile cupulate gland at the apex; pinnae unijugate, the interpetiolar and interfoliar stipules small, apiculate, puberulous,

often obsolete; secondary petioles 1 to 2.5 cm. long, the apical gland small and sometimes obsolete; leaflets unjugate, subpetiolulate, coriaceous, obliquely ovate-lanceolate or elliptic-lanceolate, obtuse at the apex, semicordate at the base, 4 to 12.5 cm. long, 2.5 to 5.5 cm. broad, the reticulate venation conspicuous on both faces.

Inflorescences spicate, single in the axils and often paniculate at the ends of the branchlets, the rachis 4-sulcate, puberulous, 7 to 12 cm. long, the flowers densely massed on the upper half; bracts often none, or represented by residual petioles; bractlets small, hairy, scaly, deciduous; flowers large, white, sessile; calyx 2.5 mm. long, densely gray-pubescent, the teeth broad and irregular; corolla 12 mm. long or over, densely grayish-sericeous, the lobes broad and subacute; stamen tube up to 25 mm. long, long-exserted; pistil up to 4 cm. long, the ovary sessile, grayish, appressed-hairy, the style glabrous.

Legume not known.

Type from Caripe, near Cumaná, Venezuela. The description given above is based upon flowering specimens collected near Miraflores, Canal Zone, Panama, July, 1911, *Pittier* 3969, and at Chepo, Panama, October, 1911, *Pittier* 4772.

The original description of this species, assuming it really applies to the Panama plant, is very unsatisfactory. Willdenow describes the stipular spines as "rectae vix visibiles minutissimae," while in fact they are large, strong, and always more or less recurved; and the leaflets are decidedly lanceolate rather than ovate-oblong. Bentham had not seen the plant when he wrote his first description³ and it is likely that the more complete diagnosis given in his later memoir⁴ is founded on Panama specimens. Walpers and Duchassaing described their Panama collection of this plant as *P. panamense*,⁴ but if Humboldt and Bonpland's name has been properly applied by Bentham, it would seem that the isthmian species is identical with the Venezuelan one. Walpers and Duchassaing described the ovary as glabrous, but in all the specimens I have dissected I found it densely appressed-hairy.

3. *Pithecollobium macrostachyum* (Vahl) Benth. Lond. Journ. Bot. 5:105. 1846.

Mimosa macrostachys Vahl, Eclog. Amer. 3:34. pl. 26. 1807.

Inga macrostachya DC. Prodr. 2:427. 1825.

This species, collected in Cayenne by von Rohr, and described by Vahl as *Mimosa macrostachys*, does not seem to have been reported again. Bentham considered it at first as synonymous with *P. lanceolatum*, but later⁵ corrected himself as follows:

"Since I have seen von Rohr's specimen of the species described by Vahl, I am inclined to think that I have confounded two distinct plants. In the one, *P. macrostachyum*, independently of the great length of the spike, the flower itself is 12.5⁶ mm. long, and the staminal tube projects 25 mm. beyond it; this species I have only seen from Cayenne. The other, *P. lanceolatum*, is indeed variable as to dimensions, but I never have seen the flower more than 6.3 mm., nor the staminal tube project more than 4 mm. beyond it; the form and size of the bracts are also very variable. This would include all my stations and synonyms except Vahl's."

³ Lond. Journ. Bot. 3:198. 1844.

⁴ Trans. Linn. Soc. 30:572. 1875.

⁴ Walp. Repert. Bot. 2:458. 1843.

⁵ Lond. Journ. Bot. 5:105. 1846.

⁶ In order to facilitate comparisons, I have reduced the lines to millimeters.

4. *Pithecollobium spinulosum* Pittier, sp. nov.

A tree, 7 to 10 meters high, the trunk up to 40 cm. in diameter; branchlets slender, flexible, with a grayish white, lenticellate bark.

Leaves bipinnate, glabrous, the stipules spinuliform, very much reduced, acute; petioles canaliculate, the main one 0.6 to 2 cm. long, with a sessile cupular apical gland; pinnae unijugate, the interpetiolar and interfoliar stipules conspicuous, subulate, spinulose, up to 3 mm. long, the secondary petioles 0.8 to 2.5 cm. long, with an apical gland; leaflets unijugate, obliquely ovate-lanceolate, obtuse at the apex, cuneate within and rounded without at the base, 2.5 to 8.5 cm. long, 1 to 4 cm. broad, light green above, paler beneath, the venation prominent on both faces.

Inflorescences spicate, loosely paniculate at the ends of the branchlets, the rachis 6 to 10 cm. long, slender, glabrous; bracts up to 5 mm. long, glabrous, with a large gland at the apex; bractlets scaly, canescent, very small; flowers sessile, slender, minutely pubescent, white, rather loose; calyx tubular, 2 to 2.5 mm. long; corolla tubular, 5 to 6 mm. long, slightly broader at the apex, the lobes about 1 mm. long; stamen tube short-exserted; pistil glabrous, dimorphous, the short form about 2.5 mm. long, the long one up to 16 mm. long.

Legume dehiscent, subsessile, glabrous, arcuate or more or less circinnate, acute at the apex, the valves 10 to 13 mm. broad.

Type in the U. S. National Herbarium, no. 920173, collected in the Lands of Loba, Department of Bolívar, Colombia, April or May, 1916, by H. M. Curran (no. 169). This collection represents the form with short style.

Another collection was made at San Martín de Loba, same region, on the same date, *Curran* 48. This is the form with long style.

This tree has the leaves of *P. lanceolatum*, but with very conspicuous spinulose petiolar stipules. The inflorescences are loose, with glabrous rachis and peculiarly shaped bractlets, which evidently represent the remnant of a petiole with its terminal gland. The flowers are like those of *P. ligustrinum*, except that the ovary is glabrous.

5. *Pithecollobium insigne* M. Micheli, Bot. Gaz. 20: 285. 1895.

A tree or shrub, the young branchlets puberulous.

Leaves bipinnate, glabrous; petioles canaliculate, pilosulous, the main one 5 to 6.5 cm. long, with a small apical gland; pinnae unijugate, the interpetiolar and interfoliar stipules slender, acute, and sometimes glandular, the secondary petioles 2 to 4 cm. long; leaflets unijugate, subpetiolulate, large, subfalcate, obliquely ovate-lanceolate, 9 to 12.5 cm. long, 3.5 to 4.5 cm. broad, acuminate or acute at the apex, glabrous, dark green above, paler beneath, the venation prominulous on both sides.

Spikes axillary or paniculate at the ends of the branchlets, loose, not very thick, tomentose, the rachis 10 to 18 cm. long; bracts small, spinulose, caducous; bractlets lanceolate-subulate, hairy, often almost as long as the calyx, subsistent; calyx sessile, densely grayish-velvety, 4 mm. long, 5 to 7-toothed; corolla 6 to 7 mm. long, densely grayish-pubescent; stamen tube exserted; pistil up to 22 mm. long, the ovary sessile, appressed-hairy.

Type in the John Donnell Smith Herbarium, collected at San Pedro Sula, Department of Santa Bárbara, Honduras, April, 1890, by C. Thieme (J. D. Smith, no. 5208).

The above description is based partly upon specimens and partly upon Micheli's description.

The original specimens are, unfortunately, incomplete, but the species appears to be well characterized by its long-petiolate leaves and elongate spikes, and by its bracteoles. Micheli seems to have been uncertain as to its position in the

genus, though there can be no doubt as to its belonging to the *P. ligustrinum* group.

6. *Pithecollobium calostachys* Standl. Contr. U. S. Nat. Herb. 20:190. 1919.
Tamaulipas to Chiapas, Mexico; type (*Palmer* 307) collected near Tampico, Tamaulipas.

7. *Pithecollobium macrosiphon* Standl. Contr. U. S. Nat. Herb. 20:191. 1919.
Based upon *Nelson* 3398, from Chiapas, Mexico.

8. *Pithecollobium lanceolatum* (Humb. & Bonpl.) Benth. Lond. Journ. Bot. 5:105. 1846.

Inga lanceolata Humb. & Bonpl.; Willd. Sp. Pl. 4:1005. 1806.

Mimosa lanceolata Poir. in Lam. Encycl. Suppl. 1:37. 1810.

A middle-sized tree, with rounded crown, the trunk short, the bark rimose or smooth, grayish or brownish, often white-lenticellate on the branchlets.

Leaves bipinnate, almost entirely glabrous, the basal stipules spinescent, straight, acute, 0.8 to 2.1 cm. long, rarely obsolete; petioles canaliculate, the main one 1.3 to 4 cm. long, with a small discoid sessile apical gland; pinnae unjugate, the interpetiolar stipule subulate, 1 to 3 mm. long, the secondary petioles 0.5 to 2 cm. long, the apical gland small and often obsolete; leaflets unjugate, coriaceous, sessile, oblique-ovate or lanceolate, broadly obtuse or subacuminate at the apex, 2 to 7.5 long, 1 to 4 cm. broad, the inner half cuneate and the outer half broadly rounded at the base, the venation more or less conspicuous on both faces.

Racemes paniculate at the ends of the branchlets, the rachis 4 to 12 cm. long, slender, grayish or brownish pubescent; bracts lanceolate, acute, hairy, often 3 mm. long caducous; bractlets very small, scaly, hairy; flowers 12 to 20 mm. long; calyx 3 mm. long (sometimes less), grayish-pubescent; corolla tubular-campanulate, 5 to 6 mm. long, grayish-pubescent, the lobes acute, about 1 mm. long; stamen tube included or more or less exserted; ovary grayish-hairy, sessile or stipitate, the style 10 to 17 mm. long, glabrous or sparsely villous.

Legume torulose, glabrous, 8 to 12-seeded, dehiscent, 10 to 14 cm. long, the valves about 1 cm. broad; seeds small, black.

The type of this species is said to be from Nova Barcelona, which now comprises the States of Anzoategui and Sucre, Venezuela. The above description is based mainly upon *Nelson* 4314.

SPECIMENS EXAMINED:

MEXICO: Mazatlán, Sinaloa, flowers, April 1, 1910, *Rose, Standley & Russell* 13852. Villa Unión, Sinaloa, flowers, April 2, 1910, *Rose, Standley & Russell* 13950. Rosario, Sinaloa, flowers, *Rose* 3162, *Rose, Standley & Russell* 14520. San Blas, Tepic, flowers, April 20, 1897, and June 6, 1897, *Maltby* 17, *Nelson* 4347. San Luis Potosí to Tampico, flowers, 1878-1879, *Palmer* 1061. Tampico, flowers, April 27, 1897, *Pringle* 7681. María Magdalena Island, flowers, May 26, 1897, *Nelson* 4314, *Maltby* 104. Vicinity of Gómez Farias, Tamaulipas, flowers, April 13-21, 1907, *Palmer* 282.

COSTA RICA: Vicinity of Nicoya, Province of Guanacaste, flowers, April, 1900, *Tonduz* (Inst. Fís. Geogr. Costa Rica, no. 13892).

VENEZUELA: Cardenas, Siquire Valley, Miranda, altitude about 500 meters, flowers, March 20, 1913, *Pittier* 6002. La Marquesa, near Guatire, Miranda, altitude 320 meters, flowers, May 12, 1918, *Pittier* 7841.

In the straight slender spines, the general shape of the leaves, whose venation is prominent on the upper face, and the paniced inflorescences at the ends of the branchlets, these specimens agree with Willdenow's description of *P.*

lanceolatum, but it is by no means certain that they correspond to his Venezuelan type. They can be distinguished easily from *P. ligustrinum* by the long straight spines, the subulate interpetiolar stipules, and the silky gray pubescence of the flowers. In the flowers the only definite characters, besides the pubescence, seem to be the length of the calyx, the shortness of the corolla tips, and the hairiness of the ovary. The corolla varies in length from 5 to 6 mm.; the ovary is either sessile or stipitate; and the length of the style varies from 9 to 17 mm. There are included here specimens with shorter stipular spines, directed upward, which, however, agree with the description in their other characters.

9. *Pithecollobium ligustrinum* (Jacq.) Klotzsch; Benth. Trans. Linn. Soc. 30: 571. 1875.

"*Mimosa ligustrina* Jacq. Fragm. Bot. Illustr. 29. pl. 32. f. 5 1800-1809."

Inga ligustrina Willd. Sp. Pl. 4: 1007. 1806.

A tree 5 to 12 meters high, the trunk up to 35 cm. in diameter; bark smooth or rimose on the trunk, densely punctate on the branchlets.

Leaves bipinnate, the basal stipules spinescent, straight, acute, 4 to 5 mm. long; petioles glabrous or puberulous, canaliculate, the main one 0.5 to 3 cm. long, with a discoid sessile apical gland; pinnae unijugate, the interpetiolar stipules acute, broad and short, the secondary petioles 0.4 to 1 cm. long, with a smaller sessile cuplike apical gland; leaflets unijugate, sessile, oblique-oblong or lanceolate, obtuse or rounded at the apex, 2 to 6.5 cm. long, 1.2 to 3 cm. broad, the outer half rounded and the inner half cuneate at the base, the upper face light green, glabrous and nitidulous, the lower face paler, glabrous except for a small hairy spot at the base on the inner side of the costa; venation reticulate, prominent on both sides.

Racemes axillary or paniculate at the ends of the branchlets, the rachis 5 to 8 cm. long, slender, pubescent; bracts very small, furfuraceous, caducous; bractlets shorter than the calyx, deciduous; flowers sessile, white, numerous; calyx tubular, 2 mm. long, irregularly 5-toothed, minutely pubescent, corolla tubular-campanulate, 5.5 mm. long, minutely pubescent, the lobes about 2 mm. long, ovate-lanceolate; stamen tube inclosed or short-exserted; pistil 6 mm. long, the ovary sessile, pubescent, ovoid, 1.5 to 2 mm. long, about 10-ovulate, the style minutely puberulous.

Legume subterete, glabrous, 8 to 12 cm. long, straight or curved, dehiscent, the valves becoming twisted; seeds compressed, rounded, black, half covered with a white aril.

Type from Caracas, Venezuela. The above description is based upon my specimens collected between Valencia and Maracay, Venezuela.

SPECIMENS EXAMINED:

MEXICO: Las Salinas, Michoacán, altitude 20 meters, flowers, May 9, 1889, *Langlassé* 151. Rosa Morada, Tepic, flowers, June 23, 1897, *Nelson* 4358. Tlacotalpam, Veracruz, flowers, May 21, 1894, *Nelson* 499. Acaponeta, Tepic, flowers, June 25, 1897, *Rose* 1470. Culiacán, Sinaloa, flowers and fruits, November 11, 1904, *Brandeggee*.

GUATEMALA: San José de Guatemala, on the Pacific coast, flowers, July 26, 1860, *Hayes*.

COLOMBIA: Santa Marta, near sea level, flowers, August, *H. H. Smith* 104.

VENEZUELA: La Victoria, Aragua, altitude 600 meters, flowers, May, 1898, *Jahn* 213. Between Valencia and Maracay, Carabobo, flowers, January 31, 1918, *Pittier* 7725. Near Colonia Tovar, *Fendler* 1875. Island of Margarita, at El Valle, flowers, July, 1903, *Miller & Johnston* 38,121,242.

The plant of Jacquin does not seem to be the same as that described later by Vahl,¹ on specimens from Santa Marta. In plate 27 of the *Eclogae* there is shown a leaf with three pinnae, each with one terminal pair of leaflets and with another of these near the base. The floral spikes seem to be fasciculate on a defoliate node. In Vahl's description of the species no mention is made of these additional leaflets, and the plant is said to be unarmed. I had no access to Jacquin's diagnosis and plate, but Willdenow's description, based on Jacquin's, applies very well to what is here considered as *P. ligustrinum*.

10. *Pithecollobium paniculatum* Pittier, sp. nov.

A bushy shrub about 4 meters high; bark of the branchlets brownish, glabrous.

Leaves bipinnate, the basal stipules spinescent, subacicular, up to 10 mm. long; petioles canaliculate, rather stout, hairy, the primary ones 0.6 to 2.5 cm. long, the apical gland small, substipitate, often obsolete; interpetiolar and terminal stipules very small, broad at base and acute at the apex; secondary petioles 0.5 to 1 cm. long, with or without an apical gland; leaflets unijugate, sessile, obovate or ovate, broadly rounded or emarginate at the apex, 2 to 4.5 cm. long, 1 to 3 cm. broad, pilosulous above, more so on the costa, pilosulous or even hairy on the costa beneath, the venation prominent on both faces.

Racemes forming axillary erect panicles up to about 7 cm. long, the rachis densely villous-canescens; bracts about 6 mm. long, formed by residual petioles, with the apical gland and stipule; racemes up to 4 cm. long, the peduncles about 2 cm. long, the flowers densely massed on the terminal part; bractlets subulate, hairy, 1 to 1.5 mm. long, caducous; calyx broad, woolly-hairy, 1.5 to 2 mm. long; corolla broadly tubular-campanulate, about 4.5 mm. long, minutely silky-pubescent, the lobes lanceolate, acute, 1.5 to 2 mm. long; stamen tube broad, included; pistil 9 to 10 mm. long, glabrous, long-stipitate (the stipe 1.2 mm. long), 7 to 10-ovulate.

Legume not seen.

Type in the U. S. National Herbarium, no. 674696, collected at San Gerónimo, Oaxaca, Mexico, December 9, 1906, by C. B. Doyle (no. 36).

A very distinct type, characterized by the disposition of the racemes in axillary panicles, the small woolly flowers, the long-stipitate ovary, and the hairiness of the leaves.

11. *Pithecollobium pulchellum* Pittier, sp. nov.

Bushy, the branchlets thick, stiff, covered with a glabrous brownish bark.

Leaves bipinnate, the basal stipules spinescent, slender, acute, up to 6 mm. long; petioles canaliculate, slender, pubescent or glabrescent, the primary ones 0.4 to 1.4 cm. long, with a small, roundish, distinctly stipitate apical gland; interpetiolar and apical stipules small, spinulose, indurate; secondary petioles 2 to 6 mm. long, the substipitate apical gland often obsolete; leaflets unijugate, subsessile, ovate, broadly rounded or subemarginate to subacute and mucronate at the apex, rounded on one side and cuneate on the other at the base, 1.3 to 3 cm. long, 0.6 to 2.3 cm. broad, glabrous above except on the minutely pubescent petiolule, paler beneath and glabrous except for a white tuft of hairs (sometimes obsolete) at the base of the inner half; venation prominulous on the lower face, almost obsolete on the upper face.

Racemes very short, grouped in distinct axillary panicles, the rachis 1 to 2 cm. long, very slender glabrous or villosulous, the heads rather short; bracts villosulous, formed by residual glandular apiculate petioles; bractlets subulate, hairy, nearly as long as the calyx or longer, caducous; flowers sessile; calyx 1.5 mm. long, tubular, hairy; corolla 4.5 to 5 mm. long, minutely pubescent,

¹ *Eclog. Amer.* 3: 34. *pl.* 27. 1807.

more so on the lobes; stamen tube broad, included; pistil up to 15 mm. long, glabrous, the ovary long-stipitate (the stipe 1 mm. long).

Legume not known.

Type in the Gray Herbarium, collected at Culiacán, Sinaloa, Mexico, by T. S. Brandegee, August 25, 1904.

This species is well characterized by its bushy habit, the small leaves with slender petioles provided with stipitate glands, the small inflorescences, and the long-stipitate ovary. Its affinities seem to be with *P. paniculatum* and *P. oblongum*, on account of the paniculate inflorescences and the stipitate ovary. It differs from both in the linear stipules, from the former in the pubescence and in the stipitate glands, and from the latter in the size of the corolla and in the shorter stipe of the ovary.

12. *Pithecollobium oblongum* Benth. Lond. Journ. Bot. 3:198. 1844.

A shrub or small tree, the bark of the young branchlets brownish, more or less densely white-lenticellate.

Leaves bipinnate, subcoriaceous, the basal stipules spinescent, glabrous, straight, thick or slender, up to 1 cm. long; petioles canaliculate, glabrous or pilosulous, the main ones 0.6 to 2.2 cm. long, with a rather small sessile pertuse apical gland; pinnae unjugate, the interpetiolar and interfoliolar stipules triangular-acute and very small, the secondary petioles 0.6 to 1.5 cm. long, with minute apical glands; leaflets unjugate, oblong, oblong-ovate, or obovate, obtuse or sometimes emarginate at the apex, subcuneate at the base, 2.5 to 4.5 cm. long, 1 to 2 cm. broad, glabrous, the venation prominulous on both sides.

Spikes forming axillary panicles, the rachis appressed-pilosulous, the bracts residual, glandular, with a terminal unguiculate appendix; peduncles 1 to 2 cm. long, slender, hairy, the spikes very short and almost globose; bractlets minute, lanceolate, hairy, deciduous; flowers small, sessile; calyx 2 mm. long, grayish-hairy; corolla 5 to 5.5 mm. long, pubescent, the lobes subacute, 1.5 mm. long; stamen tube included; pistil 14 mm. long, the ovary hairy, long-stipitate (the stipe 2 mm. long).

Legume not seen; according to Bentham, flat before dehiscence, the valves 8.5 mm. broad.

Type from Panama (*Cuming* 1155). The present description is based upon specimens in the Gray Herbarium, from Santa Marta, Colombia, *H. H. Smith* 28a. This species is reported from the Gulf of Fonseca (*Sinclair*), Nicaragua (*Oersted*), Panama (*Cuming*, *Seemann*, *Duchassaing*), and Trinidad (*Crueger*).

Bentham's diagnosis and description apply to the Santa Marta specimens, except that in these the flowers are slightly larger.

13. *Pithecollobium subglobosum* Pittier, sp. nov.

A small tree or shrub, the bark of the young branchlets brownish gray.

Leaves bipinnate, small, submembranous, the basal stipules spinescent, rather slender, up to 5 mm. long; petioles slender, canaliculate, more or less pilosulous, the main ones 1 to 1.5 cm. long, with a small stipitate apical gland; pinnae unjugate, the interpetiolar and interfoliolar stipules more or less obsolete; secondary petioles 4 to 5 mm. long, with a minute apical gland; leaflets unjugate, subsessile, glabrous, obovate, broad and more or less emarginate at the apex, rounded at the base on the outer half, 1 to 2 cm. long, 0.7 to 1.3 cm. broad, the reticulate venation prominulous on both sides.

Spikes forming axillary panicles, the rachis minutely puberulous or pubescent, the bracts residual, 1 to 2 mm. long, glandular and appendiculate at the apex by the residual interpetiolar stipule; peduncles 1 to 1.7 cm. long, slender, the

flower spikes subglobose; bractlets lanceolate, acute, hairy, very small and deciduous; flowers small, sessile; calyx 2.5 mm. long, sparsely appressed-pubescent; corolla 8 mm. long, tubular but broader at the apex, minutely and sparsely appressed-pubescent, the lobes about 1 mm. long, narrow and obtuse; stamen tube included; pistil up to 20 mm. long, the ovary glabrous, long-stipitate (the stipe 3 mm. long).

Type in the Gray Herbarium, collected at Santa Marta, Colombia, altitude about 30 meters, in September, 1898 to 1901, by H. H. Smith (no. 309a).

This species differs from *P. oblongum* in the smaller and differently shaped leaflets, in the pedicellate glands, and in the larger flowers with a glabrous ovary.

FIVE UNDESCRIBED SPECIES OF PITHECOLLOBIUM OF THE SECTIONS SAMANEA AND CAULANTHON.

Pithecollobium discolor Pittier, sp. nov.

Section *Samanea*, series *Parviflorae*. A large tree with rounded crown, the branchlets more or less pubescent.

Leaves terminal, caducous, the rachis more or less grayish-pubescent, sometimes quite glabrous; petioles about 3.5 cm. long, canaliculate, with a large ovate gland about 1 cm. above the base; pinnae 1 or 2-jugate; leaflets 2 to 4-jugate, with interfoliolar depressed discoid glands between the upper or two upper terminal pairs; petiolules 1 mm. long or less, pubescent; blades coriaceous, ovate-lanceolate to lanceolate, acute at the base, obtuse at the apex, sparsely hairy or glabrous above, paler and more or less minutely pilosulous beneath, 1 to 5 cm. long, 0.6 to 2 cm. broad, the margin thick and slightly revolute.

Inflorescences axillary, paniculate at the ends of the branchlets, the main peduncles bearing at the apex several pediceled flower heads; peduncles and pedicels grayish-pubescent, the former 4 to 12 cm. long, the latter slender, 2 cm. long; flowers small, white, pediceled; pedicels 0.9 to 1 mm. long, pubescent; calyx campanulate, 1.5 to 2 mm. long, pubescent, the teeth broad, subacute; corolla 3 to 3.5 mm. long, glabrous, the lobes ovate-lanceolate, about 1 mm. long; stamen tube included; pistil about 11 mm. long, the ovary 2 mm. long, glabrous, substipitate.

Legume flat and thin, straight, acute at base and apex, substipitate, glabrous, 10 to 12-seeded, 10 to 17 cm. long, 1.5 to 1.8 cm. broad, the peduncle about 2.5 cm. long.

Type in the U. S. National Herbarium, no. 471907, collected at La Verbena, near San José, Costa Rica, altitude about 1,000 meters, December, 1894, by A. Tonduz (Inst. Fís. Geogr. Costa Rica, no. 9077).

ADDITIONAL SPECIMENS EXAMINED:

COSTA RICA: Forested hills, Nicoya, altitude about 300 meters, fruits, January, 1900, *Tonduz* (Inst. Fís. Geogr. Costa Rica, no. 13531).

PANAMA: Hospital grounds at Ancón, Canal Zone, altitude 20 to 80 meters, flowers, February, 1911, *Pittier* 5737.

This species was distributed as *P. auaremotemo* Mart., but it belongs rather in series *Parviflorae* of the section *Samanea* on account of its small flowers, straight flat coriaceous pods, and the characters of the inflorescence.

Pithecollobium longepedatum Pittier, sp. nov.

Section *Samanea*. A large deciduous tree, the branchlets brownish-hairy.

Leaves large, soft, terminal, the rachis brownish-hairy, the petioles 5 to 11 cm. long; pinnae 2 to 4-jugate, the small glands inserted a few millimeters

below the pairs of leaflets; leaflets 3 to 7-jugate, the petiolules about 1 mm. long, hairy, the blades broadly ovate or obovate, rounded or subcuneate at the base, broadly obtuse and sometimes subemarginate at the apex, dark green, shiny, and pilosulous above, paler and sparsely hairy beneath, 1.5 to 4 cm. long, 1 to 2.5 cm. broad, the venation prominulous above, less so beneath.

Inflorescences umbellate-capitate, single or geminate in the upper axils, the peduncles 3 to 7 cm. long, brownish-hairy; flowers long-pedicellate, the pedicels about 15 mm. long, slender, hairy; calyx tubular-campanulate, broadly toothed, densely brownish-hairy, about 5.5 mm. long; corolla white, densely hairy, 9 to 9.5 mm. long, the lobes long-triangular, acute, about 3 mm. long; stamen tube included, the stamens pink; pistil about 30 mm. long, the ovary short-stipitate, pubescent.

Legume (immature) straight, hairy, short-stipitate, apiculate, about 15 cm. long and 1.2 cm. broad.

Type in the U. S. National Herbarium, no. 860140, collected at El Coyolar, near Orotina, Costa Rica, at an altitude of 100 to 200 meters, by Carlos Werckle.

I refer also to this species a flowering specimen collected in a garden at Panama City by Brother Celestine (no. 36), November 5, 1912, from a tree which is said to shed its leaves four times a year.

The species is characterized mainly by its general hairiness and the long-pedicellate flowers.

***Pithecollobium macradenium* Pittier, sp. nov.**

Section *Samanea*, series *Carnosae*. A tree, 15 to 20 meters high, the trunk 75 cm. in diameter, the crown rounded-depressed.

Rachis of the leaves minutely pubescent, the petioles 3.5 to 7 cm. long; pinnae usually trijugate, with a very large cupular coriaceous gland between the basal pair; leaflets 5 to 8-jugate, subsessile, with a more or less developed pedicellate gland at the insertion of each pair, the blades inequilateral at the base, rhombic-ovate or ovate, broadly rounded at the apex, glabrous above except for the pubescent costa, paler and more or less pilosulous beneath, 2 to 5 cm. long, 1 to 2.2 cm. broad.

Inflorescences capitate, the peduncles 5 to 6 cm. long, ferruginous-pubescent; flowers small, short-pedicellate, white; pedicels 2.5 mm. long, sparsely puberulous; calyx campanulate, 3.3 to 3.5 mm. long, puberulous, the teeth short, subacute; corolla 6 to 6.5 mm. long, the tube glabrous, the lobes lanceolate-acute, minutely brownish-pubescent; stamen tube included; pistil about 15 mm. long, the ovary short-stipitate, glabrous.

Pod thick, strongly arcuate, compressed, transversely sulcate between the seeds, about 10 cm. long, 2 cm. broad, short-stipitate, the peduncle thick, 5 cm. long.

Type in the U. S. National Herbarium, no. 716482, collected at Monte Lirio, Canal Zone, Panama, May 6, 1912, by E. D. Christopherson (no. 196).

The most remarkable character of this species is the extraordinary development of the gland at the insertion of the basal pinnae. It is often over 1 cm. long, and in its fresh condition forms a deep cup, which is usually visited by ants, according to the collector's notes. The interfoliolar glands, although of ordinary size, also are more developed than is generally the case in the genus.

***Pithecollobium chagrense* Pittier, sp. nov.**

Section *Caulantho*. A low spreading tree.

Leaves short-petiolate (petioles about 0.5 cm. long); pinnae unijugate, the rachis pubescent or subglabrous, 5 to 12 cm. long; leaflets 3-jugate, more or less alternate, coriaceous, the petiolules pubescent, 2 to 3.5 mm. long, the blades ovate-elliptic or sometimes ovate, cuneate at the base, acute at the apex, 4.5

to 14 cm. long, 2.5 to 5.5 cm. broad, the costa and basal veins very conspicuous on both sides.

Inflorescences spicate, sessile; flowers sessile, pink; calyx minutely pubescent or glabrescent, 1.7 mm. long; corolla glabrous, or penicillate at the tips of the lobes, 6.7 mm. long, the lobes ovate, acute, about 1.2 mm. long; stamen tube exserted; pistil 25 to 30 mm. long, the ovary 1.5 mm. long, brownish-pubescent, the style glabrous, filiform.

Legume flat, thin, slightly arcuate, glabrous, 6 to 12 cm. long, 2.2 cm. broad, the margin thin and distorted.

Type in the U. S. National Herbarium, no. 676943, collected on banks of the Chagres River below Gatún, Canal Zone, Panama, February 17, 1911, by H. Pittier (no. 2808).

Also collected by Fendler (no. 90) at Chagres, near the mouth of the river, February 3, 1850. It was listed under *P. latifolium* Benth., but can not belong to that species, as the inflorescences are spicate.

In this species the leaf venation is very characteristic.

***Pithecollobium pilosulum* Pittier, sp. nov.**

Section *Caulanthon*. A small tree, about 10 meters high, the trunk 40 cm. in diameter; branchlets pilosulous.

Leaves bipinnate, the petioles 0.6 cm. long, the pinnae 1-jugate, the rachis glabrous or pilosulous, 3.5 to 8 cm. long, with interjugal glands between the upper pairs of leaflets; leaflets 3 to 6-jugate, subsessile, ovate to oblong, markedly inequilateral, subacute or sometimes rounded at the base, obtuse and short-apiculate at the apex, dark green above, paler beneath and with prominent venation, the primary and secondary veins more or less pilosulous; leaflets of the basal pair smaller, 2 to 3 cm. long, 1 to 1.5 cm. broad, those of the upper pair larger, 7.8 cm. long, about 3 cm. broad.

Inflorescences ramiflorous, capitulate, pedunculate, the peduncles 1 to 1.5 cm. long; flowers sessile, glabrous, white; calyx 3 to 3.3 mm. long, the teeth broad, acute; corolla 5.5 mm. long, the lobes lanceolate, obtuse, about 2 mm. long; stamen tube long-exserted.

Legume arcuate, depressed, glabrous, short-pedunculate (peduncles about 0.5 cm. long), 5 to 20 cm. long, 1.7 to 2 cm. broad, 3 to 13-seeded, the margins prominent, more or less undulate.

Type in the U. S. National Herbarium, no. 537245, collected at San Martín de Loba and vicinity, Lands of Loba, Department of Bolívar, Colombia, April or May, 1916, by H. M. Curran (no. 88). Also collected at the same place and date by Mr. Curran under his no. 19.

This species differs from all those known in the group *Capitati* of section *Caulanthon* in the larger number of leaflets, the length of the calyx and corolla, and the breadth of the pods.

CAESALPINIACEAE.

A NEWLY REDISCOVERED SPECIES OF BROWNEA.

***Brownea leucantha* Jacq. Fragm. Bot. Illustr. 26. pl. 29, 21. 1809.**

A tree, 15 to 20 meters high, branching from the base, or with an elongate or pyramidal crown, the branchlets grayish, lenticellate.

Leaves large, glabrous, the rachis stout, stiff, 25 to 40 cm. long, glabrous, more or less lenticellate, with a thicker cylindrical basal pulvinus; leaflets 6 to 8-jugate, alternate except the basal and terminal pairs, coriaceous, eglandular, the petiolules stout, canaliculate, about 1 cm. long, the blades inequilateral, ovate to oblong, 6 to 24 cm. long, 3.5 to 6.5 cm. broad, emarginate at the base in the lower pairs, the inner half acute, the outer half rounded at the base in the

upper pairs, all acute or subacuminate at the apex, light green above, paler beneath; costa prominent and primary veins prominulous on both faces, the latter doubly anastomosing along the margin; leaflets of the first pair often cordate-acuminate and deciduous, opposite and inserted at the base of the pulvinus.

Inflorescences axillary on old branchlets, solitary, sessile, forming large white ovoid heads 10 cm. in diameter and more, 15 to 18 cm. long; rachis stout, attenuate, 7 to 9 cm. long, glabrous; bracts numerous, ovate, broadly clasping, brownish-pubescent, the exterior ones up to 8.5 cm. long; pedicels 5 to 7 mm. long, sparsely appressed-hairy; sheath about 4 cm. long, tubular and widened from base to tip, densely brown-pubescent without and within, indistinctly and sparsely costate; receptacle tube long-stipitate, the stipe about 3 cm. long, deeply sulcate, the tube 1.5 cm. long, glabrescent without; sepals 4; petals narrowly oblong-spatulate, 5 to 6 cm. long, glabrous without, sparsely long-hairy within on the blade; pistil about 6 cm. long, the ovary stipitate (stipe about 1 cm. long), densely light brown hairy, the style glabrous, slender.

Legumes 20 to 25 cm. long, 3.5 to 4.5 cm. long, 2 or 3 to each flower head, the peduncles 4 to 4.5 cm. long, glabrous, the stipe tetragonous, 1 to 2 cm. long, the whole body compressed, rufous-pubescent, the dorsal margin thin, the ventral one dilated, 5 to 6 mm. broad, bisulcate, the apex curved, acute, beaklike; seeds uniform, depressed, suborbicular, 2.7 to 3 cm. in diameter, about 8 mm. thick, finely rugose on the faces, bordered around the margin by the omphalodic band.

Type from near Caracas, Venezuela; the above description from specimens collected in the forests of Mararé, near Ocumare del Tuy, State of Miranda, Venezuela, with flowers and fruits, May 1, 1918, by H. Pittier (no. 7804).

This beautiful species, known only from Venezuela, does not seem to have been reported again since its discovery by Jacquin's collector (Bredemeyer?). It does not appear to exist any longer in the vicinity of Caracas, probably because the forests have largely disappeared, but I found it very abundant and characteristic in the forests and gorges above Ocumare, in the mountains between the northern part of the country and the llanos.

FABACEAE.

THE MIDDLE AMERICAN SPECIES OF MACHAERIUM.

KEY TO SPECIES.

Leaflets few (15 or less), medium-sized to large (mostly above 5 cm. long), acuminate, the veins remote, with the interspaces densely reticulate.

RETICULATA.

Leaves 11 to 15-foliolate; leaflets thick, ovate, acutely acuminate. Inflorescence sparsely flowered; flowers large; legume 9 to 10 cm. long, ferruginous-tomentose at the base. Panama-----1. *M. pachyphyllum*.

Leaves 3 to 11-foliolate; leaflets submembranous, elliptic or oblong, or ovate and then very large and few, obtusely acuminate.

Legume 10 to 11.5 cm. long; leaves 3 or 5-foliolate; leaflets ovate, long-acuminate, 6 to 14.5 cm. long, 3 to 8 cm. broad. Central America and Mexico-----2. *M. latifolium*.

Legume not over 6 cm. long; leaves 7 to 11-foliolate; leaflets shortly broad-acuminate, not over 8 cm. long.

Petiolules 4 to 5 mm. long; filaments glabrous; legume rather long-stipitate (the stipe 7 mm. long), ferruginous-pubescent at the base; leaflets 7.5 to 8 cm. long, 2 to 3.5 cm. broad. Panama.

3. *M. darienense*.

Petiolules 2 mm. long; filaments villous; legume short-stipitate (stipe 4 to 5 mm. long), at first minutely pubescent; leaflets 7 to 11, 1.5 to 5 cm. long, 0.7 to 2 cm. broad. Costa Rica, Panama, Colombia.

4. *M. seemanni*.

Leaflets numerous (13 and over, or fewer but then broadly rounded or emarginate at the apex), small to medium-sized (mostly less than 7 cm. long), rounded, obtuse, or emarginate at the apex, the veins close together, with the interspaces hardly or not at all reticulate.

Leaflets small (not over 1.5 cm. long), numerous, glabrous, the primary veins very close, parallel, not anastomosing. LINEATA.

Legume glabrous, the seminal part torulose; leaflets 25 to 45; rachis of the leaves hairy on the dorsal side only; stipules glabrous. Panama.

5. *M. glabripes*.

Legume densely golden-setulose, the seminal part broad and flat; leaflets 41 to 65; rachis ferruginous-tomentellous all over; stipules ferruginous-hairy at first. Panama-----

6. *M. cirrhiferum*.

Leaflets usually medium-sized (1 to 7 cm. long), rarely very small (4 to 8 mm. long), glabrous or hairy, the primary veins not very close together, sparsely but distinctly anastomosing. OBLONGA.

Leaflets 31 to 61, 4 to 8 mm. long; stipules scarious or sometimes indurate, densely ferruginous-pubescent; seminal part of the pod yellowish-villous. Panama-----

7. *M. arborescens*.

Leaflets usually less numerous and larger (1 to 7 cm. long); stipules indurate-spinescent, hairy or glabrous, sometimes caducous.

Leaflets ovate-oblong or obovate, obtuse or emarginate at the apex, glabrous, at least on the upper face.

Leaflets obovate, deeply emarginate at the apex, entirely glabrous.

Pod long-stipitate, the seminal part minutely pubescent. Mexico.

8. *M. acanthothyrsus*.

Leaflets ovate-oblong, obtuse or retuse at the apex, more or less hairy on the lower face.

Plant an unarmed tree; rachis of the inflorescence ferruginous-pubescent; flowers 12 to 13 mm. long, violet; seminal part of the pod broad and thick, more or less setulose. Mexico.

9. *M. langlassel*.

Plant a trailing armed shrub; rachis of the inflorescence more or less tomentose; flowers 6 to 7 mm. long, dark purple; pods glabrous at maturity. Panama-----

10. *M. purpurascens*.

Leaflets oblong, rounded or subacute at the apex, more or less hairy on both faces.

Inflorescences very large (up to 40 cm. long), the rachis glabrous or sparsely hairy. Leaflets 41 to 55, very narrow (5 to 8 mm. broad), villous-tomentose on both faces. Costa Rica.

11. *M. costaricanum*.

Inflorescences not over 30 cm. long, the rachis densely hairy, sometimes setulose.

Leaflets 13 to 19, obtuse or subacute and mucronulate at the apex, puberulous above, tomentellous beneath; flowers 12 to 13 mm. long. Guatemala-----

12. *M. cobanense*.

Leaflets 31 to 41, rounded or more or less emarginate at the apex, villosulous on both sides; flowers 9 to 10 mm. long. Mexico;

Guatemala-----

13. *M. setulosum*.

DESCRIPTION OF SPECIES.

1. *Machaerium pachyphyllum* Pittier, sp. nov.

"A spreading tree, about 7 meters high, with a trunk 17.5 cm. in diameter," or "a shrub, with a stem up to 10 cm. in diameter, trailing on trees," the older stems covered with a gray glabrous bark, the younger stems densely setose-aculeate, the shoots ferruginous-tomentose.

Leaves 11 to 15-foliolate, the rachis 12 to 23 cm. long, subangular, at first densely ferruginous-tomentose, later glabrous; leaflets coriaceous, the petioles ferruginous-hairy or glabrous, subcanaliculate, 4 to 6 mm. long, the blades ovate or ovate-oblong, rounded at the base, abruptly short-acuminate at the apex, 3.5 to 9.5 cm. long, 1.8 to 4 cm. broad, glabrous, or the costa densely ferruginous-hairy beneath, strongly reticulate on both faces, more or less lustrous on the upper one; stipules caducous, ovate, subacuminate, about 1 cm. long, scarious or subindurate, filmy-tomentose on both sides.

Inflorescences axillary or terminal, often growing from defoliate nodes on the old wood, long and broadly paniculate, twice ramified, brownish-tomentose, the main rachis 14 to 60 cm. long, the primary branchlets (often geminate) up to 9 cm. long; peduncles 3 to 10-flowered, 3 to 5 cm. long; bracts and bractlets caducous; pedicels 3 to 5 mm. long, densely brownish-hairy; flowers about 15 mm. long; bractlets orbicular, obtuse or subtruncate at the apex, 5.5 mm. long and broad, brownish-tomentose without; calyx campanulate, about 8 mm. long, densely brownish-tomentose without, the teeth subacute, almost equal in length; petals purplish; standard reflexed, densely brownish-pubescent without, glabrous within, the claw about 1.5 mm. long, the blade orbicular, rounded at the base, emarginate at the apex, 12 mm. long, 14.5 mm. broad; wings glabrous, subfalcate, oblique, the claw about 3 mm. long, the blade 1-auriculate, obovate, rounded at the apex, 11 to 11.5 mm. long, 5 to 5.5 mm. broad; carinal petals glabrous, 1-auriculate, strongly falcate, the claw 3 to 3.5 mm. long, the blade about 11 mm. long, 3.5 mm. broad; stamens monadelphous, glabrous, the anthers subglobose; ovary 1-ovulate, short, stipitate, densely villous, provided at the base with a tubular glabrous disk nearly 2 mm. long; style filiform, about 5.5 mm. long.

Legume 9 to 10 cm. long, stipitate, the stipe about 11 mm. long, the seminal part 2.5 cm. long and 1.2 cm. broad, more or less ferruginous-tomentose, the wing cultriform, glabrous, reticulate-veined, 2 cm. broad, subobtuse at the apex.

Type in the U. S. National Herbarium, no. 677922, collected in the vicinity of Penonomé, Province of Coclé, Panama, in flower, February or March, 1908, by R. S. Williams (no. 107). The description of the fruit is from specimens in the herbarium of the New York Botanical Garden, obtained at the same locality and date (*Williams* 397.)

The type specimen is said to have been obtained from a tree, and the fruiting specimens, accompanied also by flowers, to have come from a trailing shrub. We are thus led to believe that this species varies in habit according to environment, and the same apparent contradiction in regard to other species of the genus leads to a like conclusion as to this dimorphism. I have myself never noticed a pronounced diversity in the habit of *Machaerium* species, but I have in Panama often found *Clitoria arborescens* Ait. growing in cleared places as a low, erect shrub, while in the forest it was decidedly a trailer, with long vinelike stems.

While *Machaerium pachyphyllum* is easily recognized as a member of the section *Reticulata* Benth., its nearer affinities are not easy to determine. It is characterized by its thick leaflets, variable indument, and very large flowers and pods.

2. *Machaerium latifolium* (Benth.) Pittier.

Machaerium acuminatum latifolium Benth. Journ. Linn. Soc. Bot. 4: Suppl. 65. 1860.

A tree; branchlets terete, glabrous, sparsely verruculose.

Leaves 3, 4, or 5-foliolate, glabrous, turning blackish in drying, the rachis terete, thick at the base, 9 to 15 cm. long; leaflets subcoriaceous, the petiolules canaliculate, black, 4 to 5 mm. long, the blades ovate, rounded or broadly cuneate at the base, abruptly and narrowly long-acuminate at the apex (the acumen often 2.5 cm. long), 6 to 14.5 cm. long, 3 to 8 cm. broad, paler on the lower face, densely reticulate-veined; stipules caducous, wanting.

Inflorescences racemose, axillary, simple, the rachis glabrous, 2 to 5 cm. long; bractlets persistent, small, broader than long, concave; flowers sessile, their structure not known.

Legume 10 to 11.5 cm. long, stipitate (the stipe minutely pubescent, 4 to 8 mm. long), the seminal part straight, at first pubescent, later glabrous, about 3 cm. long and 2 cm. broad, the blade cultriform, obtuse, 2.5 to 3 cm. broad; seed ovate-scutellate, depressed, about 1.5 cm. long, 2 to 2.5 cm. broad, attenuate toward the base of the pod, broadly obtuse at the other end, with a narrow notch on the carinal margin, this corresponding with the insertion of the hilum.

The description is drawn from specimens collected in the forests of Santo Domingo de Osa, Costa Rica, in fruit, March, 1896, by A. Tonduz (Inst. Fís. Geogr. Costa Rica, no. 10069). The same species has been reported from Nicaragua (*Oersted*), Jalapa, Mexico (*Galeotti*), and Mount Orizaba, Mexico (*Botteri* 1031).

Bentham considered this only a variety of *Machaerium acuminatum*, a conclusion in which I can not concur, for the leaves and fruits are constantly larger, and the leaflets of different shape. The flowers will probably furnish good differential characters. These two species, with *M. brasiliense*, form a distinct group of closely related species.

3. *Machaerium darienense* Pittier, sp. nov.

A small unarmed tree; branchlets terete, lenticellate, glabrous (in the fruiting specimens).

Leaves 7-foliolate, the rachis slender, subterete, 6 to 10 cm. long, minutely grayish-pubescent; leaflets subcoriaceous, the petiolules terete, glabrous, 4 to 5 mm. long, the blades ovate or oblong, broadly cuneate or rounded at the base, obtusely acuminate at the apex, 5 to 8 cm. long, 2 to 3.5 cm. broad, glabrous and prominulous-reticulate above, prominulous-reticulate and sparsely grayish-pubescent along the costa beneath; stipules not seen.

Inflorescences axillary or terminal, the rachis fuscous-pubescent, 3 to 7 cm. long, simple or ramified; bractlets persistent, pubescent, cucullate; flowers sessile; bractlets pubescent, about 1.5 mm. long and much broader; calyx about 3 mm. long, sparsely pubescent, striate; standard minutely grayish-pubescent without; filaments glabrous; anthers ovoid-globose; other details of the flower not known.

Legume 5 to 5.5 cm. long, long-stipitate (the stipe about 7 mm. long), ferruginous-pubescent, the seminal part straight, about 2 cm. long, 1 cm. broad, the wing cultriform, rounded, mucronulate, 1.4 cm. broad; seed oblong, compressed, rounded-obtuse at both ends, about 7 mm. long, 14 mm. broad.

Type in the U. S. National Herbarium, no. 715743, collected in the vicinity of La Palma, southern Darién, Panama, in fruit, January 26, 1912, by H. Pittier (no. 5497).

The present species belongs to the group of *Machaerium seemanni*, on account of its sessile flowers and other characters, but it differs in its pubescence, the number, shape, and size of its leaflets, and its rather long-stipitate and broader pods.

4. *Machaerium seemanni* Benth. in Seem. Bot. Voy. Herald 110. 1853.

Machaerium campylocarpum Donn. Smith, Bot. Gaz. 44: 109. 1907.

An unarmed spreading shrub; branchlets terete, striate, at first ferruginous-pubescent.

Leaves 7 to 11-foliolate, the rachis slender, 5.5 to 9 cm. long, terete, sparsely ferruginous-hairy; leaflets coriaceous, the petiolules about 2 mm. long, ferruginous-hairy, the blades ovate or ovate-lanceolate, rounded or subemarginate at the base, short-obtuse or acute-acuminate at the apex, 1.5 to 5 cm. long, 0.7 to 2 cm. broad, glabrous, lustrous and dark green above, paler beneath, more or less villous or pilosulous, especially along the costa, and finely reticulate; stipules caducous, wanting.

Inflorescences axillary or terminal, racemose, the rachis (or peduncle) not over 2 cm. long, ferruginous-pubescent; bracts and bractlets persistent, shorter than broad, truncate, conchoid, minutely pubescent; flowers sessile, about 7 mm. long; bractlets suborbicular (broader than long), ferruginous-pubescent, 1 to 1.5 mm. long; calyx persistent, campanulate, 3 to 3.5 mm. long, densely ferruginous-hairy, the teeth inconspicuous; petals persistent, purple; standard orbicular, ferruginous-sericeous, the claw very short, the blade orbicular, subemarginate at the base, bilobulate at the apex, about 5.5 mm. long and 7 mm. broad; wings elongate, the claw 1.5 to 2 mm. long, the blade auriculate, obovate, densely villous-barbate without, 5.5 mm. long, 2.3 mm. broad; carinal petals falcate, the claw as in the wings, the blade broad, straight on the vexillar margin, densely villous-barbate on the carinal half without, about 5 mm. long and 3 mm. broad; stamens monadelphous, the filaments villous; ovary pubescent, 1-ovulate.

Legume 5 to 6 cm. long, short-stipitate (the stipe 4 to 5 mm. long), at first minutely pubescent, the seminal part arcuate, 2 cm. long and 7 to 9 mm. broad, the wing obtuse or subacute, 1.5 to 1.7 cm. broad, the vexillar margin thin and arcuate, the carinal margin almost straight and thick.

Type from El Boquete de Chiriquí, Panama (*Seemann* 1681).

SPECIMENS EXAMINED:

COLOMBIA: Foothills of Santa Marta, altitude about 700 meters, flowers, June, 1900, *Herbert H. Smith* 2038.

PANAMA: Arid hills near Las Cruces de Churué, between Aguadulce and Olá, Province of Coclé, fruits, December 9, 1911, *Pittier* 5094. Cerro Vaca, eastern Chiriquí, altitude 900 meters, fruits, December 26, 1911, *Pittier* 5310.

COSTA RICA: Hacienda Jiménez, Peñas Blancas, Diquís Valley, altitude 600 meters, flowers and fruits, February 7, 1898, *Pittier* (Inst. Fís. Geogr. Costa Rica, no. 12163).

The first diagnosis of this species, described from Chiriquí, does not mention the fruit. In his Synopsis of Dalbergiae, published seven years later, *Bentham* completed his first description with that of a pod of a Venezuelan specimen, *Fendler* 1685, representing a very closely related but certainly distinct species. This resulted in Capt. John Donnell Smith's redescribing the shrub as a new species. My specimens from Panama agree perfectly with the original diagnosis and I have been able to convince myself by direct comparison that they are absolutely identical with the type of *Machaerium campylocarpum* Donn. Smith.

5. *Machaerium glabripes* Pittier, sp. nov.

A small armed tree, about 6 meters high, with a trunk 10 cm. in diameter at the base; young branchlets subangular, minutely pubescent, sparsely lenticellate.

Leaves 25 to 45-foliolate, the rachis slender, canaliculate, 4 to 7 cm. long, hairy on the dorsal side only; leaflets coriaceous, glabrous, the petiolules distinct but less than 0.5 mm. long, the blades oblong, rounded or subcuneate at the base, rounded or truncate and submucronate at the apex, 3 to 10 mm. long, 1.5 to 3 mm. broad, dark green above, paler beneath, the veins numerous, parallel, not anastomosing, running into the marginal nerve; stipules of the older branchlets indurate-spinescent, slender, acute, about 5 mm. long, those on the new branchlets ovate-acuminate, scarious, glabrous.

Flowers not known.

Legume 4.5 to 5 cm. long, glabrous, long-stipitate (stipe pubescent, about 8 mm. long), the pedicel ferruginous-pubescent, 3 to 4 mm. long, the seminal part dark brown, torulose and striate or verruculose, sharply bent, the wing membranous, cultriform, more or less obtuse, apiculate, 1.3 to 1.5 cm. broad.

Type in the U. S. National Herbarium, no. 678107, collected in fruit only in the vicinity of Penonomé, Province of Coclé, Panama, March, 1908, by R. S. Williams (no. 410).

The specimens agree with the description of the leaves and general characters of *M. glabratum*, except as to the size of the leaves, but without having seen the flowers of the Panama tree it is impossible to determine exactly its relationship to the Colombian plant.

6. *Machaerium cirrhiferum* Pittier, sp. nov.

A trailing armed shrub, the stems 2.5 to 5 cm. in diameter; branchlets often spirally twisted, at first densely ferruginous-pubescent.

Leaves 41 to 65-foliolate, the rachis slender, 7 to 16 cm. long, canaliculate, ferruginous-tomentellose; leaflets subcoriaceous, glabrous, the petiolules 0.5 mm. long or less, the blades oblong, rounded at the base, rounded and slightly emarginate at the apex, 4 to 15 mm. long, 3 to 6 mm. broad, pale beneath, the veins sinuous, numerous, more or less anastomosing, running into the marginal nerve; stipules indurate-spinescent, short, stout, arcuate, at first ferruginous-hairy.

Inflorescences terminal, up to 40 cm. long, broad, the rachis densely ferruginous-pubescent; bracts stipule-like; peduncles few-flowered; pedicels stout, 3 mm. long, densely ferruginous-hairy; bractlets large, suborbicular, striate, ferruginous-pubescent; calyx campanulate, about 5 mm. long, ferruginous-tomentellose; standard grayish-pubescent without.

Legume 4 to 5.5 cm. long, not stipitate, the seminal part 1.5 cm. long and about 1 cm. broad, densely golden-setose, the wing cultriform, rounded at the apex, 1.5 to 1.8 cm. broad, sparsely tomentose.

Type in the U. S. National Herbarium, no. 678111, collected in the vicinity of Penonomé, Province of Coclé, Panama, in fruit, March, 1908, by R. S. Williams (no. 416).

This species is well characterized by its tendril-like branchlets and by having the fruit almost sessile and covered with a golden-yellow indument.

7. *Machaerium arborescens* Pittier, sp. nov.

A tree about 12 meters high, the trunk 10 cm. in diameter; branchlets stout, grayish, more or less lenticellate, at first densely grayish-tomentose.

Leaves 31 to 61-foliolate, more or less fasciculate at the ends of the short branchlets, the rachis slender, 2.5 to 8.5 cm. long, densely ferruginous-pubescent; leaflets membranous, inequilateral, the petiolules hairy, not over 0.5 mm. long,

the blades oblong, rounded at the base, obtuse or slightly emarginate at the apex, 4 to 8 mm. long, 1 to 3 mm. broad, villous at the base above, paler and sparsely villous all over beneath, the veins distant, distinctly anastomosing, running into the marginal nerve; stipules mostly scarious, sometimes indurate, lanceolate-acuminate, densely ferruginous-pubescent without, caducous or subpersistent.

Inflorescences axillary, 5 to 15 cm. long, subpaniculate or the peduncles inserted directly on the main rachis; rachis densely ferruginous-tomentose; peduncles 3 to 10-flowered; bracts stipule-like; pedicels 3 to 5 mm. long; bractlets orbicular, about 4 mm. long and broad; calyx campanulate, about 7 mm. long, densely ferruginous-hairy; standard densely grayish-hairy without.

Legume 5 to 5.5 cm. long, not stipitate, the seminal part 1.5 cm. long and 1.3 cm. broad, densely villous-tomentose with brown and yellow hairs, the wing obovate, subcultriform, more or less villous or pilosulous, about 1.8 cm. broad.

Type in U. S. National Herbarium, no. 678106, collected near Penonomé, Province of Coclé, Panama, March, 1908, by R. S. Williams (no. 409).

This species belongs to the section *Oblonga*, but its affinities are doubtful and are difficult to determine in the absence of flowers.

8. *Machaerium acanthothyrsus* Pittier, sp. nov.

A tree (?); branchlets terete, glabrous.

Leaves 9-foliolate, the rachis glabrous, subterete, 5 to 10 cm. long; leaflets coriaceous, subopposite, the petiolules 1 to 2 mm. long, glabrous or pilosulous, the blades broadly ovate or (in the terminal leaflet) obovate, rounded or (in the terminal leaflet) cuneate at the base, broadly rounded, emarginate, and distinctly mucronulate at the apex, 2 to 5.5 cm. long, 1 to 2.5 cm. broad, glabrous, paler beneath, the veins numerous, parallel, profusely anastomosing; stipules indurate-spinescent, lanceolate, acute, recurved, glabrous, up to 5 mm. long.

Inflorescence terminal, paniculate, up to 30 cm. long, the rachis (in the fructiferous panicle) glabrous; peduncles (branchlets of second order) short, ferruginous-pubescent, few-flowered; pedicels ferruginous-pubescent, 3 to 4 mm. long; bracts conspicuous, indurate-spinescent, straight or more or less pubescent at the base, smooth and sharp-pointed at the apex, up to 4.5 mm. long; bractlets caducous, not seen; calyx persistent, tubular-campanulate, about 4 mm. long, ferruginous-pubescent; other details of the flower not known.

Legume 6 to 7.5 cm. long, long-stipitate (the stipe 8 to 9 mm. long, pubescent), the seminal part 2 to 2.5 cm. long, 0.9 cm. broad, curved, tuberculate over the seed, sparsely pubescent, the wing membranous, cultriform, obtuse, reticulate, 12 to 15 mm. broad.

Type in the U. S. National Herbarium, no. 1,059,397, collected on the road between Hacienda del Capricho, Guerrero, and Llano Grande, Oaxaca, Mexico, altitude 65 to 100 meters, February 16, 1895, by E. W. Nelson (no. 2331).

Very closely related to *Machaerium langlassei* Micheli, collected in the same region, but differing in indument, number and shape of leaflets, and rather profusely aculeate panicle. If the fruit specimen described for the latter species has been correctly identified, other differential characters may be found in the fruits.

9. *Machaerium langlassei* Micheli, sp. nov.

An unarmed tree, 5 to 12 meters high, with rounded crown; branchlets terete, at first densely ferruginous-pubescent.

Leaves 13 to 21-foliolate, the rachis 10 to 18 cm. long, angular or subterete, at first densely ferruginous-pubescent, later glabrous or glabrescent; leaflets coriaceous, the petiolules 2 to 3 mm. long, pubescent, the blades oblong,

rounded or acuminate at the base, rounded and slightly retuse at the apex, 2 to 7 cm. long, 1.3 to 2.3 cm. broad, glabrous and dark green above, paler beneath and more or less villous, especially along the costa, the veins crowded, parallel, running into the marginal nerve, more or less anastomosing through intermediate veinlets; stipules caducous, wanting.

Inflorescence paniculate, axillary or terminal, 15 to 25 cm. long, simply branched, longer than the leaves, the rachis densely ferruginous-pubescent; peduncles solitary or 2 or 3-fasciculate, sometimes branched, cymose, 3 to 13-flowered, 2 to 6 cm. long; bracts and bractlets caducous, not seen; pedicels densely ferruginous-pubescent, 2 to 3 mm. long; flowers 12 to 13 mm. long; bractlets suborbicular, 2.5 to 3.5 mm. long and broad, ferruginous-pubescent without; calyx campanulate, 5 to 6 mm. long, densely ferruginous-pubescent, the teeth obtuse or subacute, the carinal tooth longer and narrower; petals violet; standard pubescent (more so toward the base) without, the claw short (about 1 mm. long), the blade suborbicular or obovate, attenuate-acute at the base, slightly emarginate at the apex, with rounded unequal lobes, about 11.5 mm. long, 11 mm. broad; wings strongly falcate-arcuate, glabrous, the claw 3 mm. long, the blade about 12 mm. long, 3.5 to 4 mm. broad; carinal petals strongly arcuate, glabrous, auriculate on the vexillar side, subacute at the apex, the claw 2 to 2.5 mm. long, the blade about 11 mm. long, 3.5 to 4 mm. broad; stamens monadelphous, glabrous, the anthers ovate, attenuate to the apex; ovary stipitate, densely grayish-villous, 1-ovulate, strongly arcuate, provided at the base with a glabrous tubular disk, 1.5 to 2 mm. long; style articulate and sparsely villous at the base, nearly 4.5 mm. long, perpendicular to the stipe.

Legume 6 to 7 cm. long, stipitate, the stipe and seminal part ferruginous-hairy and more or less setose, the former about 7 mm. long, the latter brown, 2 cm. long, 1 cm. broad, arcuate toward the apex, the wing cultriform, obtuse, sparsely hairy or glabrescent, 4 cm. long 1.7 cm. broad; seed brown, reniform, about 6 mm. long, 13 mm. broad.

Type in the Gray Herbarium, collected at Cerro Pedregoso and El Ocote, Guerrero, Mexico, altitude 300 meters, in flower, October 28, 1898, by E. Langlassé (no. 526). The description of the fruit is from specimens collected at El Rancho, Department of Jalapa, Guatemala, January 23, 1908, by W. A. Kellerman (no. 5599).

Collected also in the neighborhood of Alajuelita, near San José, Costa Rica, in flower, September, 1890, by A. Tonduz (Inst. Fís. Geogr. Costa Rica, no. 3000).

This species, which is apparently widely spread over the semiarid districts of southern Mexico and Central America, escaped the attention of the earlier collectors. The Costa Rican specimens were identified by Micheli as *M. moritzianum* Benth. (a very distinct species), an identification which was followed by Capt. John Donnell Smith in his determination of the Guatemalan tree.

10. *Machaerium purpurascens* Pittler, sp. nov.

An armed, trailing or scandent shrub, the stems about 5 cm. in diameter, 3 to 4 meters long; branchlets terete, purplish brown, striate, at first brownish-hairy, later glabrous.

Leaves distichous, 17 to 27-foliolate, the rachis 7 to 12 cm. long, slender, more or less grayish or brown-tomentose; leaflets subcoriaceous, the petiolules hairy, not over 1 mm. long, the blades ovate-oblong or obovate, slightly inequilateral, rounded or (in the terminal leaflet) cuneate at the base, more or less obtuse and mucronulate at the apex, 1 to 4 cm. long, 0.4 cm. broad, glabrous, dark green and punctulate above, paler beneath, punctulate, and more or

less villous, the veins distant, anastomosing, inconspicuous; stipules triangular-acute, 4 to 5 mm. long, at first scarious and villous-tomentose, later indurate-spinescent, arcuate, glabrous.

Inflorescences paniculate, axillary or terminal, up to 15 cm. long, the rachis terete, 3 times ramified; branchlets of the first order brownish-pubescent or sometimes densely canescent-tomentose, the others densely villous-tomentose; bracts of the first order more or less indurate and glabrescent, those at the base of the peduncles broadly triangular, acute, scarious, densely villous without, glabrous inside; peduncles (branchlets of the third order) 5 to 12-flowered, sometimes ramified, 1 to 2 cm. long; flowers 6.5 to 7 mm. long, the pedicels hairy, up to 2 mm. long, subtended at the base by a minute persistent bractlet; bractlets suborbicular, glabrous or sparsely pilosulous, about 1 mm. long, 1.5 mm. broad, persistent; calyx persistent, campanulate, 3.5 mm. long, purple, glabrous or more or less puberulous on the margin, the teeth subequal, subacute, the vexillar ones broader; petals pinkish purple; standard reflexed, densely brownish-pubescent without, the claw about 1 mm. long, the blade suborbicular (shorter than broad), broadly truncate or subemarginate at the base, deeply emarginate at the apex (the lobes broadly rounded), 4 to 5.5 mm. long, 7 to 8 mm. broad; wings broadly obovate, glabrous, the claw arcuate, about 2 mm. long, the blade oblique, auriculate on the vexillar side at the base, broadly obtuse, about 4.5 mm. long, 3.5 mm. broad, the carinal margin reflexed; carinal petals falcate, glabrous, the claw as in the wings, the blade auriculate on the vexillar side at the base, subacute at the apex, about 4.5 mm. long, 2.5 mm. broad; stamens monadelphous, glabrous, the filaments arcuate; ovary 1-ovulate, stipitate (without basal disk), densely villous-tomentose, the style slender, straight, glabrous.

Fruits yellowish green or purplish, at first ferruginous-pubescent, glabrous when fully ripe, short-stipitate, 4.5 to 5 cm. long, the seminal part about 8 mm. broad, the wing cultriform, rounded-obtuse and apiculate at the apex, up to 12 mm. broad.

Type in the U. S. National Herbarium, no. 676886, collected at Ancón, Canal Zone, Panama, in flower, February 14, 1911, by H. Pittier (no. 2749).

The following additional specimens may be cited:

PANAMA: Open slopes of old French cut near Bohío, Canal Zone, immature flowers, February 12, 1911, *Maxon* 4783. Vicinity of Penonomé, Province of Coclé, immature fruits, February or March, 1908, *Williams* 112, 413, 414, 415. Vicinity of La Palma, southern Darién, flowers, January 26, 1914, *Pittier* 5495. Panama, flowers, March, 1847, *Seemann* 465.

This is probably the species collected in Panama by Hayes (no. 328), Sinclair, and Hinds, and identified as *M. angustifolium*. It belongs, however, to the section *Oblonga* and differs from that species in the general purplish coloration of the branchlets, flowers, and fruits, in the number, size, and shape of the leaflets, and in the peculiar shape of the standard and wings.

11. *Machaerium costaricanum* Pittier, sp. nov.

An armed shrub (or a small tree?); branchlets subangular, at first pilosulous, later glabrous.

Leaves 41 to 55-foliolate, the rachis 18 to 25 cm. long, slender, densely ferruginous-hairy; leaflets membranous, the petiolules hairy, about 1 mm. long, the blades narrowly oblong, rounded at the base, rounded or slightly emarginate at the apex, 2 to 3.5 cm. long, 5 to 8 mm. broad, more or less villous-tomentose on both faces, the veins numerous, parallel, sparsely anastomosing, running into the marginal nerve; stipules indurate-spinescent, slender, sharp, about 8 mm. long.

Inflorescences paniculate, terminal, very large (up to 40 cm. long), the main rachis thick, glabrous, sparsely lenticellate, the branchlets up to 25 cm. long, sparsely hairy; peduncles (branchlets of the second order) geminate, ferruginous-hairy, 4 to 8-flowered, 1.5 to 3 cm. long; bracts and bractlets scarious, lanceolate, pilosulous, early deciduous; pedicels hairy, 1.5 to 2 mm. long; flowers about 9 mm. long; bractlets ovate, obtuse or subacute, glabrous or pilosulous, 3 to 3.5 mm. long, 2 to 2.5 mm. broad; calyx campanulate, 5.5 to 6.5 mm. long, purple, glabrous or sparsely villous on the margin, the carinal tooth longer, rounded, the vexillar teeth also rounded, broader and irregular; petals purple; standard reflexed, densely gray-villous without, the claw oblique, about 1.5 mm. long, the blade ovate-oblong, rounded and broader at the base, emarginate with rounded lobes at the apex, about 10.5 mm. long, 9 mm. broad; wings long and narrow, glabrous, the claw about 2.5 mm. long, the blade oblique-oblong, arcuate, 1 or 2-auriculate at the base, 8 to 9.5 mm. long, 3 mm. broad; carinal petals strongly arcuate, glabrous, 1-auriculate, the claw as in the wings, the blade about 9 mm. long and 2.5 to 3 mm. broad; stamens monadelphous, glabrous, the filaments thicker than the oblong anthers; ovary 1-ovulate, stipitate, strongly arcuate, densely grayish villous-tomentose, provided at the base with a glabrous tubular disk; style very short (about 0.7 mm. long), glabrous.

Fruit wanting.

Type in the John Donnell Smith Herbarium, collected in forest along Río Celbo, near Buenos Aires, Diquís Basin, Costa Rica, altitude about 300 meters, flowers, February, 1891, by A. Tonduz (Inst. Fís. Geogr. Costa Rica, no. 3816).

Determined as *Machaerium lanatum* Tulasne by Micheli, but differing in the number and venation of the leaflets, the general indument, the pedicellate flowers, and the size of the panicles. It is related to *M. purpurascens*.

12. *Machaerium cobanense* Donn. Smith, Bot. Gaz. 44: 108. 1907.

A trailing armed shrub, the stems up to 10 meters long; branchlets terete, lenticellate, at first grayish-tomentose.

Leaves 13 to 19-foliolate, the rachis slender, 9 to 15 cm. long, tomentulose; leaflets coriaceous, the petiolules brownish-hairy, 1 to 2 mm. long, the blades oblong, rounded or subacute at the base, obtuse or subacute and mucronulate at the apex, 1 to 5.5 cm. long, 0.4 to 2.5 cm. broad, dark green and more or less puberulous above, paler and tomentulose beneath, the veins more or less straight, anastomosing and running into the marginal nerve; stipules indurate-spinescent, recurved, acute, up to about 5 mm. long, caducous.

Inflorescences terminal, paniculate, up to 30 cm. long, the rachis densely yellowish-hairy; peduncles (branchlets of the second order) usually simple, 3 to 5-flowered; bracts stipule-like, caducous; bractlets not seen; pedicels hairy, 1 to 3.5 mm. long; flowers 12 to 13 mm. long; bractlets orbicular, yellowish-hairy, 2 to 2.5 mm. long, 3 mm. broad; calyx tubular-campanulate, about 6 mm. long, hairy, the 3 lower teeth narrow and subacute, the 2 vexillar ones very broad and short; petals purplish; standard densely gray-pubescent without, the claw broad, 1.5 to 2 mm. long, the blade suborbicular, more or less attenuate at the base, broadly rounded and emarginate at the apex, about 7.5 mm. long, 8.5 to 9 mm. broad; wings obovate, oblique, not auriculate, glabrous, the claw 2.5 to 3 mm. long, the blade obtuse, 7 mm. long, 4 mm. broad; carinal petals slightly falcate, auriculate, glabrous, the claw 3 mm. long, the blade about 5 mm. long and 3 mm. broad; stamens monadelphous, glabrous, the anthers ovoid; ovary 1-ovulate, straight, stipitate, villous, provided at the base with a short tubular disk; style glabrous, incurved, about 0.8 mm. long.

Fruit not known.

Type in the John Donnell Smith Herbarium, collected near Cobán, Alta Verapaz, Guatemala, in flower, August, 1906, by H. von Türckheim (no. II. 1401).

Placed by Captain Smith in the section *Reticulata*, but evidently a species of the *Oblonga* group, near *M. purpurascens* Pittier, from which it differs by the larger flowers and the pubescence, and in other minor characters.

13. *Machaerium setulosum* Pittier, sp. nov.

An armed scandent shrub; branchlets terete, striate, glabrous or more or less villous or pubescent.

Leaves 31 to 49-foliolate, the rachis 12 to 24 cm. long, tapering from the base, more or less villous or puberulous; leaflets subcoriaceous, the petiolules reddish, pubescent, 0.5 to 1.5 mm. long, the blades oblong, slightly inequilateral, rounded at the base, rounded and more or less emarginate at the apex, 2.5 to 4 cm. long, 7 to 13 mm. broad, minutely pubescent, villosulous or glabrous above, paler and villosulous (principally along the costa) beneath, the veins numerous, more or less parallel, anastomosing but running into the marginal nerve; stipules indurate-spinescent, acute-lanceolate, often 1 cm. long, at first subscarious and hairy, sometimes early deciduous.

Inflorescences paniculate, terminal, 15 to 30 cm. long, the main rachis thick, villous or glabrescent, the branchlets densely hairy, the peduncles (branchlets of the second order) grayish-setulose and hairy, 2 to 3-fasciculate, often branched, 5 to 10-flowered, 2 to 7 cm. long; bracts of the first order deciduous, scarious, broadly lanceolate-subulate, more or less villous, striate, provided at the base with a bunch of bright yellow bristles; bracts of the second order scaly, clasping, hairy, early deciduous; bractlets very small, hairy; pedicels 2 to 5 mm. long, hairy, setulose at the apex; flowers 9.5 to 10 mm. long; bractlets ovate, concave, about 3.5 mm. long, 3 mm. broad, striate and setulose without; calyx persistent, campanulate, about 5 mm. long, purple, sparsely setulose without, the teeth rounded (the carinal one longer, the vexillar ones very broad and irregular); petals pinkish purple; standard reflexed, densely silky-pubescent without, the claw oblique, 1.5 or 2 mm. long, the blade orbicular, slightly emarginate at the apex, about 6 mm. long and broad; wings obovate, oblique, the claw about 2 mm. long, the blade 1-auriculate and sparsely villous at the base, broadly rounded at the apex, 6 to 6.5 mm. long, 3.5 to 4 mm. broad; carinal petals falcate, sometimes sparsely villous on the carinal margin, the claw as in the wings, the blade rounded-auriculate on the vexillar side, subacute at the apex, about 6.5 mm. long and 3 mm. broad; stamens glabrous, the filaments thicker than the oblong anthers; ovary 1-ovulate, stipitate, canescent-hairy, surrounded at the base with a cuplike disk; style short (about 1.5 mm. long), glabrous or sparsely villous.

Young fruits sparsely villosulous, long-stipitate (the stipe about 1.5 cm. long, gray-pubescent); mature fruits wanting.

Type in U. S. National Herbarium, no. 841737, collected at Zacuapan, Veracruz, Mexico, in flower, April, 1907, by C. A. Purpus (no. 2430).

Additional specimens have been examined as follows:

MEXICO: Zacuapan, Veracruz, flowers and young fruits, April, 1913, *Purpus* 6327. Córdoba Valley, Veracruz, flowers, February 25, 1866, *Bourgeau* 1987.

GUATEMALA: San Gerónimo, Sierra de las Minas, altitude about 1,300 meters, flowers, March 1, 1907, *Kellerman* 6359.

This species, represented in all collections at my disposal, was uniformly labeled *M. angustifolium* Vog., apparently on the authority of Hemsley. It differs, however, in the peculiar setulose indument of the inflorescence, in the size of the leaflets, and in the shape and dimensions of the floral parts.

BURSERACEAE.

TWO PANAMANIAN SPECIES OF PROTIUM.

***Protium ternatum* Pittier, sp. nov.**

A small tree, with smooth gray bark.

Leaves membranous, glabrous, ternate, 15 to 30 cm. long, the petioles stout, subterete, 2.5 to 3.5 cm. long; leaflets large, petiolulate, the petiolules canaliculate, thickened at the apex, those of the lateral ones 0.7 to 1.5 cm. long, that of the terminal one 2.5 to 4 cm. long, the blades ovate-elliptic, acute at the base, obtusely short-acuminate at the apex, 10 to 22 cm. long, 4 to 8 cm. broad, the costa prominent on both sides, the main lateral veins (about 10) and the minor venation prominulous and reticulate.

Inflorescences up to 15 cm. long, axillary, ramified from the base, few-flowered, glabrous, the branches slender and angular; flowers pedicellate, greenish yellow, the pedicels 3 to 5 mm. long; calyx shallowly 4-lobulate, glabrous; petals 4, broadly ovate, obtuse or sometimes acute at the apex, 2.5 mm. long, 1.6 to 2.2 mm. broad, glabrous or sometimes minutely pubescent toward the tip; stamens 8, the filaments broader at the base, about 2 mm. long, the anthers small, ovoid; disk thick, annular, sulcate, glabrous, covering about half the ovary; ovary subglobose, glabrous, 4 or 5-celled, the style very short, the stigma 4 or 5-lobed.

Drupe oblique-ovoid, acute, apiculate, about 1 cm. long, glabrous, orange-red.

Type in the U. S. National Herbarium, no. 679294, collected along Río Fató (Nombre de Dios), Province of Colón, Panama, in flower, August 16, 1911, by H. Pittier (no. 4190). A second collection, same locality and date, is *Pittier* 4191.

This species seems to be nearly related to *Protium guianense* Marchal, but it differs in the peculiar structure of the petiolules, the size of the leaflets, the length of the pedicels, and the shape of the petals. Besides, the leaves have always three leaflets or fewer, while in *P. guianense* they are sometimes bijugate.

***Protium inconforme* Pittier, sp. nov.**

A small tree, the bark of the branchlets smooth and light gray.

Leaves glabrous, 2 or 3-foliolate, up to 12 cm. long, the petioles rather slender, at first distinctly canaliculate above, 1 to 1.5 cm. long; leaflets very variable in size, the petiolules 0.3 to 1 cm. long, canaliculate, the blades narrowly elliptic to ovate, obtuse at the base, obtuse or obtusely subacuminate at the apex, 4 to 10 cm. long, 1.5 to 4 cm. broad, the costa prominent on both faces, the main nerves (about 12) and the reticulate veins and veinlets more or less prominent beneath.

Inflorescences short, in solitary axillary few-flowered racemes, up to 2.5 cm. long, the rachis sparsely puberulous; flowers pediceled, pale yellow, the pedicels 2 to 3 mm. long, puberulous, provided at the base with a brown scarious ciliate deciduous bractlet; calyx 4 or 5-lobed, the lobes broad, short, obtuse; petals 4 or 5, 2.5 mm. long, 1 to 1.5 mm. broad, subacute, glabrous or minutely puberulous; stamens 8 or 10, the filaments 0.7 to 1 mm. long, the anthers small, ovoid; ovary subovoid or globose, surrounded by the glabrous disk only at the base, sparsely hairy, about 0.8 mm. long, the style much shorter, 4 or 5-lobulate.

Fruit ovoid-oblong, stipitate, apiculate, 2-seeded, glabrous, about 2 cm. long; seeds somewhat 3-carinate, 1.1 cm. long.

Type in the U. S. National Herbarium, no. 677733, collected in forest near Caldera, Chiriquí, Panama, in flower and fruit, March 21, 1911, by H. Pittier (no. 3350).

The most conspicuous feature of this species consists in the irregularity of the leaves, which are at times 2-foliate, one of the leaflets then with a longer petiolule, and at other times regularly ternate. But for this particular the description agrees in the main with that of *Protium hostmanni* Engl. and also with *Protium confusum* (Rose) Pittier,⁸ both of which have from 3 to 7 leaflets.

The tree is known among the natives under the name of "chutra."

RUTACEAE.

THREE NEW SPECIES OF ZANTHOXYLUM FROM PANAMA.

Zanthoxylum panamense P. Wils., sp. nov.

A tree, 10 to 15 meters high, the trunk 30 cm. in diameter at the base, armed in its lower third with conical corky prickles; twigs puberulent with mostly appressed hairs, leaves odd-pinnate, 10 to 20 cm. long; petioles and rachis grooved above, glabrous or somewhat puberulent; leaflets 5 to 9, opposite or subopposite, oblong-lanceolate to obovate or elliptic, 4 to 9 cm. long, 2 to 4 cm. broad, acuminate at the apex, acute to cuneate and more or less inequilateral at the base, short-petioluled or sessile, lustrous and glabrous above, paler beneath, glabrous and reticulate-veined, the margin entire or obscurely crenulate; pellucid glands scattered, unequal in size, the marginal glands rather distant; inflorescence terminal, paniculate, the branches densely puberulent; flowers unknown; sepals 5, triangular; immature follicles 3 or 4.

Type in the U. S. National Herbarium, no. 677881, collected on Mamei Hill, Canal Zone, Panama, altitude 20 to 90 meters, July 6, 1911, by H. Pittier (no. 3809).

The corky prickles of the lower third of the trunk are said to be often hollow and inhabited by ants.

Zanthoxylum pittieri P. Wils., sp. nov.

A tree, 20 meters or more in height, with a trunk 35 to 40 cm. in diameter, armed with stout hard-corky compressed subpyramidal elevations 2.5 to 3 cm. broad, these supporting prickles; branches bearing grayish brown, helmet-shaped prickles 8 to 12 mm. long; petiole and rachis terete or nearly so, puberulent; leaves even-pinnate, 25 to 30 cm. long; leaflets 6 or 8, alternate, short-petioluled, oblong-oval to oval, 8 to 14 cm. long, 5.5 to 8 cm. broad, rounded and with a short broad mucro at the apex, inequilateral and somewhat rounded at the base, entire, glabrous and shining above, paler and more or less puberulent (especially on the midrib and veins) beneath, the lateral veins 5 to 8 mm. distant, prominent, the veinlets reticulate; panicle 20 to 25 cm. long, the branches distant, lax, loosely flowered, minutely hispidulous with reddish hairs; calyx of the (immature) staminate flowers 1 to 1.2 mm. broad, the lobes 5, suborbicular; petals 5, ovate to elliptic, 2 mm. long, 1 mm. broad; stamens 5, the anthers elliptic; abortive carpels 3; pistillate flowers and follicles unknown.

Type in the U. S. National Herbarium, no. 716006, collected at Boca de Paurandó, on Sambú River, southern Darién, Panama, altitude 20 meters, February, 1912, by H. Pittier (no. 5713).

⁸ *Icica confusa* Rose, N. Amer. Fl. 25: 260. 1911.

Zanthoxylum setulosum P. Wils., sp. nov.

A tree, 10 to 15 meters high, with the twigs, rachis, petioles, foliage, and branches of the inflorescence hispidulous; branches unarmed, or armed with prickles 2 to 2.5 mm. long; leaves odd-pinnate, 15 to 35 cm. long; leaflets 17 to 21, opposite or subopposite, oblong-lanceolate, 3 to 7 cm. long, 1 to 1.8 cm. broad, long-acuminate at the apex, inequilateral and more or less acute at the base, dark green and hispidulous (especially along the midrib) above, paler and hispidulous on the midrib and veins beneath, sessile, the margin crenulate; glands bordering the margin pellucid; inflorescence paniculate; flowers unknown; sepals 5, hispidulous; immature follicles 5.

Type in the U. S. National Herbarium, no. 678564, collected on rocky exposed slopes along the Chagres River above Alhajuela, Province of Panama, Panama, May 13, 1911, by H. Pittier (no. 3515).

THEACEAE.**A NEW SPECIES OF EURYA FROM PANAMA.****Eurya seemanniana** Pittier, sp. nov.

A tree of medium size; bark of twigs smooth and sparsely verrucose on older parts, densely hairy on young growth.

Leaves petiolate, subcoriaceous; petioles hairy, canaliculate, 1.5 cm. long, obscurely decurrent; leaf blades ovate-lanceolate, acuminate, decurrent to the base of the petiole by 2 narrow hairy wings, 7 to 10 cm. long, 2.5 to 4 cm. broad, glabrous above, with salient veins, silky-pubescent beneath, the margin entire.

Flowers polygamous, pedicellate, in clusters of 3 or 4 in the axils of the leaves, or in former foliate buds, opening one at a time in each cluster; pedicels 3 to 8 mm. long, hairy, provided at the base with a small ovate-acuminate tomentose bract about 3 mm. long; bractlets suborbicular, about 2 mm. long and 3 mm. broad, hairy outside, sepal-like and adherent to the calyx; sepals ovate-rounded, 4 mm. long and broad, coriaceous, silky-hairy outside; petals connate at base, oval, more or less rounded and reflexed at the tip, 6 to 8 mm. long, glabrous, white; stamens 23 to 25, 4 or 5 adherent to the base of each petal, about 2.2 mm. long, reduced to filaments in fertile flowers; pistil 3.5 mm. long; ovary ovate, attenuate to a short style; stigmas 3, ovate-acuminate, white, divided to the base.

Fruit not known.

Type in the U. S. National Herbarium, no. 677040, collected on the edge of pastures around El Boquete, Chiriquí, Panama, altitude 1,000 to 1,300 meters, in flower, March 3, 1911, by H. Pittier (no. 2944).

This species is probably the plant collected by Seemann (no. 1153) in the same locality and left unnamed by him. It is nearly related to *E. sericea* (Humb. & Bonpl.) Szysz., but differs in having the leaves smaller, with entire margin and a winged petiole, in its pedicellate flowers, and in its short hairy calyx.

SAPOTACEAE.**THE CENTRAL AMERICAN SPECIES OF LUCUMA.**

On several occasions⁹ I have described species of *Lucuma* proceeding from various parts of Central America, but mainly from Panama. Further studies with reference to a few of these trees have shown that

⁹ Contr. U. S. Nat. Herb. 13: 457. 1912; 18: 85. 1914; 18: 166. 1916.

two of them have been placed in the wrong genus and should be referred to *Labatia*, as they have hairy fruits and a calyx formed by two pairs of sepals. These are my *Lucuma standleyana* and *L. sambuensis*.¹⁰ The mistake was due to the incompleteness of the specimens at my disposal, aided no doubt by my being unfamiliar with a genus not known before to exist in Central America.

Lately two new species of *Lucuma* have been recognized in the unnamed part of my collection, and these are described below. The number of species reported from Central America thus remains at five, of which two have almost always pentamerous flowers, two have hexamerous flowers with 8 or 9-celled ovaries, and the remaining one has 6 sepals but is pentamerous in the other parts of the flower. This last species, *L. sclerocarpa*, is remarkable also on account of its sclerotic fruits, which are perhaps unique in the genus.

The chief distinguishing characters of these five species are brought together in the following key.

Fruit sclerotic, pyriform, one-seeded. Sepals 6; corolla, androecium, and ovary pentamerous. (Panama.) ----- 1. *L. sclerocarpa* Pittier.

Fruit berry-like, with a fleshy mesocarp.

Ovary 8 to 9-celled; sepals and corolla lobes 6. Primary veins of the leaves 12 to 15.

Corolla 14 to 14.5 mm. long, hairy within. (Panama.)

2. *L. glabrifolia* Pittier.

Corolla 11.5 to 12 mm. long, glabrous within. (Guatemala.)

3. *L. laeteviridis* Pittier.

Fruit depressed-globose, 1 to 5-seeded, the ovary 5-celled. (Costa Rica; cultivated.) ----- 4. *L. obovata* H. B. K.

Fruit fusiform, truncate at the base, obtusely attenuate at the apex, 1-seeded, the ovary 6-celled. (Central America.)

5. *L. salicifolia* H. B. K.

This key does not complete the possible list of species of *Lucuma* in Central America. Up to 1910, when I started studying this interesting group, about 8 species of Sapotaceae had been reported from the region between the Isthmus of Tehuantepec and that of Darién. To-day 27 species are listed.

***Lucuma glabrifolia* Pittier, sp. nov.**

A small tree with pyramidal crown; branchlets glabrous; leaf buds minutely ferruginous-pubescent.

Leaves membranous, congested on the new growth at the ends of the branchlets, glabrous, the petioles slender, semiterete, 2 to 3 cm. long, the blades obovate, long-cuneate at the base, abruptly and shortly obtuse-acuminate at the apex, 11 to 20 cm. long, 4 to 8.5 cm. broad, light green and lustrous above, paler and dull beneath, entire, the primary veins 12 to 15, light colored when dry, conspicuous but neither impressed nor prominent above, prominent (like the costa) beneath, the intervenal spaces minutely reticulate.

Flowers pedicellate, rather short and broad, in clusters of 3 to 5 at the ends of the branchlets; basal bractlets small, hairy, deciduous; pedicels minutely

¹⁰ *Labatia standleyana* Pittier. *Lucuma standleyana* Pittier, Contr. U. S. Nat. Herb. 18: 166. 1916. *Labatia sambuensis* Pittier. *Lucuma sambuensis* Pittier, Contr. U. S. Nat. Herb. 18: 167. 1916.

ferruginous-pubescent, about 1 cm. long; calyx short, broad, the sepals 6, ovate to oblong, concave, coriaceous, minutely ferruginous-pubescent without, 10 to 12 mm. long, 6 to 8 mm. broad, the interior ones narrower and longer; corolla tubular, pale yellow, 14 to 14.5 mm. long, the tube about 3 mm. long, glabrous or sparsely pilosulous without, the lobes 6, oblong, obtuse, glabrous on the margin, densely appressed-villous at the middle without, the whole corolla more or less grayish-pilosulous inside, principally at the base of and on the lobes; staminodia linear, acute, 3 to 3.5 mm. long, papillose near the apex, more or less grayish-hairy at the base; stamens 6, 2 to 3 mm. long, the filaments 0.5 to 1.5 mm. long, more or less hairy, the anthers cordate-lanceolate, about 2 mm. long; pistil 1.5 cm. long, the ovary ovoid or subglobose, 8 or 9-celled, ferruginous-hairy, the style thickest at the base, glabrous, distinctly capitellate.

Fruit not known.

Type in the U. S. National Herbarium, no. 716608, collected in the forests around Pinogana, southern Darién, Panama, April 17, 1914, by H. Pittier (no. 6542).

Very closely related to *L. laeteviridis* Pittier, on account of the 8 or 9-celled ovary and certain other details, but differing in the greater size of the flowers, the indument of the corolla, the shape of the anthers, and the glabrous leaves.

Lucuma laeteviridis Pittier, sp. nov.

A deciduous tree, about 15 meters high, the trunk erect, about 35 cm. in diameter at the base, the crown ovoid-pyramidal; bark of the branchlets brownish, more or less appressed-pubescent on the younger parts.

Leaves membranous, congested at the ends of the branchlets, the petioles sulcate above, about 3 cm. long, minutely appressed-pubescent, the blades obovate-elliptic, cuneate at the base, abruptly obtuse-acuminate at the apex (the acumen narrow, 1 to 1.5 cm. long), 10 to 30 cm. long, 6 to 10 cm. broad, glabrous, entire, the primary veins 13 to 15, prominent on the light green lower face, subimpressed on the darker upper face.

Flowers rather large, solitary or several together in the axils of the leaves or on the defoliate branchlets, the basal bracts very small, scarious, hairy, deciduous, the pedicels slender, minutely pubescent, 1.2 to 1.7 cm. long; sepals 6, ovate, concave, minutely pubescent without, 6.5 to 8 mm. long, 6 cm. broad, the interior ones smaller; corolla tubular, yellowish white, 11.5 to 12 mm. long, glabrous at the base, covered on the upper half with appressed silvery hairs, the lobes 6, ovate, obtuse or truncate at the apex, 2 to 2.5 mm. long; staminodia 6, linear, minutely pubescent on the sides, papillose at the apex, about 3.5 mm. long; stamens 6, inserted very high on the corolla tube, glabrous, 3 to 3.5 mm. long, the filaments about 2 mm. long, the anthers introrse, ovate-oblong, attenuate toward the apex, cordate at the base, 2 to 2.5 mm. long; pistil 11 mm. long, the ovary subglobose, tomentose, 8 or 9-celled, the cells 1-ovulate; style glabrous, subcapitellate.

Fruit not known.

Type in the U. S. National Herbarium, no. 1,012,336, collected in forests at Las Playitas, Department of Izabal, Guatemala, May 18, 1919, by H. Pittier (no. 8534).

In this species the calyx, corolla, and androecium are hexamerous, and the ovary is 8 or 9-celled, a combination not reported for any other member of the genus except *L. glabrifolia*, which excludes these two trees from the nearly related groups. In the absence of fruit their real place remains doubtful. Among the natives of the Motagua Valley the tree is called "ingerto de montaña," which would indicate a supposed relation to *Calocarpum viride*; the fruit is the "zapotillo calenturiento."

A NEW SPECIES OF SIDEROXYLON.

Sideroxylon hondurense Pittier, sp. nov.

A large tree, about 18 meters high; crown broad, divaricately branched; younger branchlets minutely pubescent.

Leaves alternate, at first membranous and more or less puberulous, with age coriaceous, glabrous and glossy above; petioles semiterete, canaliculate, 1 to 1.5 cm. long; blades ovate-oblong or ovate-elliptic, more or less rounded-cuneate and slightly decurrent at the base, subacuminate and obtuse at the apex, 7 to 13 cm. long, 3 to 6 cm. broad, the costa prominent beneath, the primary veins about 17, prominulous, distant, strongly arcuate close to the margin.

Flowers pedicellate, numerous in clusters in the axils of defoliate nodes of the preceding year's growth, the bracts very small, scarious, pubescent; pedicels pubescent, 3 to 5 mm. long; calyx 5-lobate, about 4.3 mm. in diameter, more or less puberulous, the lobes imbricate, unequal, ciliate, ovate, broadly rounded at the apex, 1.8 to 2.5 mm. long (measured from the center of the calyx), 1 to 1.5 mm. broad; corolla subrotate or broadly campanulate, greenish yellow, 5 to 6 mm. in diameter, the lobes 5, suborbicular, 1.5 to 2 mm. long and broad, glabrous except for the ciliate margin; staminodia 5, inserted at the lobular sinuses, often partly obsolete, linear-acute, entire, 0.9 to 1.2 mm. long, papillose at the apex; stamens 5, inserted at the base of the corolla tube, included, glabrous, about 1 mm. long, the filaments linear-apiculate, the anthers extrorse in bud, ovate; ovary depressed, 2-celled, hairy, 5-tuberculate at the base, attenuate to a short obtuse glabrous style.

Fruit not known.

Type in the U. S. National Herbarium, no. 1,012,335, collected on the banks of the Chamelecón River at La Florida, Department of Copán, Honduras, May 10, 1919, by H. Pittier (no. 8480).

VERBENACEAE.

THE MIDDLE AMERICAN AND MEXICAN SPECIES OF VITEX.

KEY TO SPECIES.

Cymes forming axillary or terminal panicles, these either subcylindric or broadest at the base and narrowed toward the apex; leaflets 3 to 7, but normally 5. PANICULATÆ.

Panicles subcylindric, narrow and short-branched.

Leaflets oblong-elliptic, softly hairy beneath, up to 20 cm. long; style glabrous. (Colombia.)

1. *V. columbiensis* Pittier.

Leaflets ovate or obovate, entirely glabrous and lustrous above; style sparsely hairy. (Colombia.)

2. *V. berteriana* Pittier.

Panicles ovate or pyramidal, usually ample. Style densely barbate at the base and hairy throughout. Leaflets entirely glabrous. (Mexico.)

3. *V. capulin* Pittier.

Leaflets rounded or subemarginate at the base.

Plant a shrub; corolla 12.5 mm. long. (Mexico.)

4. *V. pyramidalis* Robinson.

Plant a tree; corolla 9 mm. long. (Yucatán.)

5. *V. gaumeri* Greenm.

Leaflets attenuate or cuneate at the base. Trees.

- Petioles 5 to 6 cm. long; corolla about 7.5 mm. long, barbate at the throat. (Panama.)-----6. *V. masoniana* Pittier.
- Petioles 9 to 12 cm. long; corolla 12 to 14 mm. long, puberulous at the throat. (Central America.)-----7. *V. longeracemosa* Pittier.
- Cymes not paniculate, few-flowered, sometimes in subcorymbose inflorescences; leaflets 3 to 7, normally 3 or 5. CYMOSAE.
- Cymes simple, long-pedunculate.
- Leaves 3-foliolate. Corolla tube 3 times as long as the calyx. (Trinidad, Venezuela.)-----8. *V. divaricata* Swartz.
- Leaves 5-foliolate.
- Leaflets sessile or almost so; corolla tube only twice as long as the calyx. (Venezuela.)-----9. *V. bignonioides* H. B. K.
- Leaflets distinctly petiolulate; corolla tube much longer than the calyx. Corolla woolly at the throat; calyx distinctly but shortly repand-dentate. (Trinidad, Venezuela.)-----10. *V. capitata* Vahl.
- Corolla almost glabrous at the throat; calyx hardly denticulate. (British Guiana.)-----11. *V. schomburgkiana* Schauer.
- Cymes corymbose.
- Leaflets 3.
- Petioles, rachis of the inflorescence, and inferior face of the leaflets softly tomentose. (Mexico.)-----12. *V. mollis* H. B. K.
- Petioles and rachis of the inflorescence minutely pubescent, the mature leaflets glabrous. (Panama.)-----13. *V. floridula* Duchass. & Walp.
- Leaflets 5 or 7.
- Calyx distinctly toothed; leaflets gray-tomentose beneath. (Brazil, Colombia.)-----14. *V. cymosa* Bert.
- Calyx hardly denticulate; leaflets glabrous. (Venezuela.)
15. *V. orinocensis* H. B. K.

DESCRIPTION OF SPECIES.

***Vitex columbiensis* Pittier, sp. nov.**

A tree, 10 meters high; trunk 30 cm. in diameter at the base; new growth, petioles, and rachis of the inflorescence more or less puberulous.

Leaves 4 or 5-foliolate, the petioles stout, subcanaliculate, 3.5 to 6.5 cm. long; petiolules 2 to 7 mm. long; leaflet blades oblong-elliptic or obovate acutely attenuate at the base, obtuse (or even emarginate), acute, or acutely subacuminate at the apex, 3.5 to 20 cm. long, 2 to 7 cm. broad, glabrous and impressed-reticulate above, densely and sordidly pilose-tomentose beneath, with prominent costa and lateral veins.

Cymes in narrow axillary elongate panicles 10 to 19 cm. long, the main rachis slender, the peduncles 4 to 7 cm. long, the branchlets not over 3 cm. long; bractlets oblong or lanceolate, 3 to 4 mm. long, densely grayish-hairy; pedicels 1 to 3.5 mm. long, grayish-pubescent; calyx campanulate, grayish-hairy, 4 mm. long, 5 or 6-toothed, the teeth nearly 1 mm. long, narrow, obtuse or subacute; corolla blue, 10 mm. long, glandular-pubescent without, hairy at the insertion of the stamens and at the base of the median lobe within, the tube 3.8 mm. long, the inferior median lobe suborbicular, about 4 mm. long and broad, the upper lobes rounded and very small (1 mm. long); stamens didynamous, exserted, the longer ones about 4.5 mm. long, the filaments densely hairy at the base and at the tip, sparsely so between, the anther cells divaricate; ovary subglobose, hairy, the style 4.7 mm. long, straight, thicker and bifid at the apex, glabrous.

Drupe not seen.

Type in the U. S. National Herbarium, no. 537283, collected on the trail from Norosí to Tiquisio, Lands of Loba, Department of Bolívar, Colombia, April or May, 1916, by H. M. Curran (no. 131).

***Vitex berteriana* Pittier, sp. nov.**

A tree (?); branchlets, petioles, and rachis of inflorescence more or less puberulous or glabrescent.

Leaves 5-foliolate, the petioles broad, flattened and shallowly canaliculate, 3 to 3.5 cm. long, the petiolules glabrous, canaliculate, 2 to 7 mm. long; leaflet blades obovate or ovate, abruptly cuneate-attenuate at the base, obtuse, sub-emarginate or abruptly narrowed to a very short, obtuse or acute acumen at the apex, perfectly glabrous above, the costa impressed, the main veins prominulous, the lesser veins minutely prominulous-reticulate on both sides; blade of the middle leaflet 8 to 9 cm. long, 4.5 to 5 cm. broad, those of the lateral leaflets smaller.

Cymes in subcylindric panicles, these about 12 cm. long (the length of the leaves) and 3 cm. in diameter, the peduncles axillary and subterminal, 4 to 6 cm. long; lateral branchlets not more than 2.5 cm. long; bractlets acicular, hairy, up to 2 mm. long, caducous; lateral pedicels slender, pubescent, 2 to 3 mm. long, bearing at the apex 2 small caducous bractlets; central pedicel stout, 1 to 1.5 mm. long; calyx broadly cupulate, 5-toothed, sparsely and minutely pubescent, the teeth densely hairy at the tips, the 3 inferior ones longer and more approximate than the 2 superior ones, the sinuses rounded; corolla large and broad, 13.5 mm. long, purplish blue, the tube about 4 mm. long, over 2 mm. broad, glabrous at the base outside, minutely pilosulous above, within more or less hairy at the insertion of the stamens and on the side corresponding to the inferior median lobe; lobes obtuse, the inferior median one orbicular, 6.5 mm. long and 8.5 mm. broad, almost glabrous without, long-barbellate at the base within (the margin sinuate-lobulate), the lateral and superior lobes much smaller, entire, pubescent without, glabrous within; stamens didynamous, exserted, the longest ones about 6 mm. long, the filaments covered with long hairs, the anther cells ovate-fusiform, strongly divergent; ovary globose, finely pubescent, the style 7 mm. long, sparsely covered with long hairs.

Drupe not seen.

Type in the U. S. National Herbarium, no. 704075, collected in the forests of Santa Marta, State of Bolívar, Colombia, by H. H. Smith (no. 2107).

This species is characterized by its short-petiolate leaves, with leaflets absolutely glabrous and apparently quite developed at the blossoming time, and by the large flowers and the hairy style. Except that it belongs to the group with cylindrical panicles, it does not seem to be very closely related to any of the species known from northern South America.

***Vitex capulin* Pittier, sp. nov.**

A tree, 6 to 10 meters high; young branchlets furfuraceous-pubescent.

Leaves subcoriaceous, 5-foliolate, the petioles canaliculate, more or less puberulous, 3.5 to 5 cm. long; petiolules puberulous, deeply canaliculate, 1 to 4 mm. long; leaflet blades ovate to elliptic-lanceolate, cuneate at the base, obtuse, acute, or subacuminate at the apex, glabrous on both faces, the costa and primary veins subimpressed and the reticulation indistinct on the upper face, the lower face pale, with the veins and venules prominulous, the reticulation close but minute and delicate; blade of the middle leaflet 3 to 10.5 cm. long, 3.5 to 4.5 cm. wide, those of the lateral leaflets much smaller.

Panicles axillary, as long as the leaves or longer (up to 15 cm. long), ovate, the lower branch longer, the peduncles 3.5 to 7 cm. long, more or less puberulous; bractlets ovate, acute, 2 to 2.5 mm. long, puberulous without, caducous or

subpersistent; flowers purple, the terminal one of each dichotomy subsessile, the lateral ones rather long-pediceled, the pedicels pubescent, the terminal one up to 1 mm. long, the lateral ones 3 to 4 mm. long; calyx campanulate, 5-toothed, 4 mm. long, grayish-pubescent, usually subtended by two bractlets, the teeth broadly rounded-triangular, with acute sinuses; corolla 14 mm. long, pilosulous and minutely glandular without on the upper part of the tube and at the base of the lobes, the tube about 7 mm. long, rather narrow, barbellate at the insertion of the stamens within, the lobes rounded-obtuse, the inferior median one suborbicular, contracted at the base, about 4.5 mm. in diameter, barbate at the base, slightly sinuate on the margin, the lateral and inferior lobes much shorter, glabrous within; stamens didynamous, the longer pair about 6.5 mm. long, the filaments densely long-hairy, the anther cells divaricate; ovary small (hardly 1 mm. in diameter), globose, densely white-pubescent, the style 8.5 mm. long, densely barbellate at the base, sparsely long-hairy throughout.

Drupe not seen.

Type in the U. S. National Herbarium, no. 386318, collected at Cuesta del Peregrino, State of Michoacán or Guerrero, Mexico, April 15, 1899, by E. Langlassé (no. 994). Another collection was made by the same collector at San Diego, in the same region, in flower, May 3, 1898 (*Langlassé* 133).

Vitex capulin differs from the other known Mexican species in its entirely glabrous leaflets and glandular calyx and corolla, and in the pronounced hairiness of the filaments and the style. The panicles, although distinctly broader at the base, are far less ample than those of *V. pyramidata* Robinson and *V. gaumeri* Greenm.

This species is known among the natives as "capulín," a name applied also to several species of the genus *Prunus*.

***Vitex longeracemosa* Pittier, sp. nov.**

A tree; young growth and petioles and the rachis of the inflorescence more or less cano-pubescent.

Leaves 5 or 6-foliolate, almost fully grown at time of flowering, the petioles stout, cano-pubescent or glabrescent, shallowly canaliculate, 9 to 12 cm. long; petiolules cano-pubescent, canaliculate, 1 to 2.2 cm. long; leaf blades ovate-elliptic to elliptic-lanceolate, more or less cuneate or acute at the base, acutely long-acuminate at the apex, pilosulous or glabrescent above, more or less cano-tomentulose beneath, the costa and primary veins impressed, the venules hardly conspicuous above, all very prominent and reticulate beneath; blade of the middle leaflet 14 to 17.5 cm. long, 4 to 6.5 cm. broad, those of the lateral leaflets 9 to 12 cm. long, 3.5 to 5.5 cm. broad.

Cymes paniculate, the rachis cano-pubescent; panicles axillary, ample, about 25 cm. long, or as long as the leaves, the peduncular part 3 to 10 cm. long; flowers bluish purple, all pediceled; bracts and bractlets caducous, ovate or ovate-oblong, not over 2.5 mm. long, cano-hairy without, glabrous within; pedicels about 3 mm. long; calyx campanulate, 2.5 to 3 mm. long, puberulous-canescens, subbilabiate, acutely 5-toothed, 3 teeth on the inferior lip (the middle one broader and shorter), 2 teeth on the upper lip; corolla 12 to 14 mm. long, bilabiate, sparsely evanescent-puberulous without, barbellate at the insertion of the stamens and puberulous at the base of the inferior lip within, the tube 5.5 to 6 mm. long, the inferior lip trilobate, the median lobe longer (6 mm.) and broader (5 mm.) than the exterior ones (4 mm. long, 2.5 mm. broad), the superior lip bilobate, with short rounded lobes; stamens 4, exserted, the filaments arcuate, about 5.5 mm. long, sparsely covered with rather long hairs, the anthers ovate; ovary subglobose, glabrous at the base, cano-hairy on the upper half, the style glabrous, about 7 mm. long.

Fruit globose, about 12 mm. in diameter, the calyx apparently caducous and not accrescent.

Type in the U. S. National Herbarium, no. 1,012,333, collected at Quiriguá, Guatemala, May 31, 1919, by H. N. Whitford and L. R. Stadtmiller (no. 74).

I refer with doubt to this species specimens collected between La Zumbadora and San Antonio, Department of Copán, Honduras, in flower, May 8, 1919 (*Pittier* 8470), and at Quebradas, Department of Izabal, Guatemala, May 19, 1919 (*Pittier* 8599).

This species belongs to the group of *V. pyramidata* Robinson and *V. gaumeri* Greenm. From the first it differs in the indument, size, and shape of the leaves, in the hairy filaments, and in being a tree and not a shrub; from the latter it differs in the larger and reticulate leaflets, these cuneate at the base, and in the larger flowers with hairy and not pubescent filaments. The three species agree in their ample panicles and in their secondary characters.

Vitex capitata Vahl, *Eclog. Amer.* 2: 50. pl. 18. 1798.

A tree; new growth, petioles, rachis of the inflorescence, and lower face of the leaflets puberulous at first, glabrous at later stages.

Leaves 4 or 5-foliolate, appearing with the flowers, the petioles 6 to 12 cm. long, canaliculate, the petiolules 0.2 to 1 cm. long, the middle one longest; leaflet blades ovate to lanceolate, cuneate-attenuate at the base, more or less abruptly acuminate, with the apex obtuse or acute, 4.5 to 12.5 cm. long, 1.5 to 5 cm. broad, the costa impressed, the primary veins slightly prominent on the upper face, moderately conspicuous beneath, the reticulation very fine and inconspicuous.

Cymes axillary, 3 to 6-flowered, short, subcapitate, the peduncles about 2 cm. long, erect, the pedicels puberulous, 1.5 mm. long; bracts and bractlets caducous, not seen; calyx small, broadly campanulate, 2 mm. long or less, the margin sinuate or indistinctly 5-dentate; corolla large (17.5 mm. long); the tube 7.5 mm. long, puberulous without, hairy within at the insertion of the stamens, the lobes ovate to oblong, obtuse, more or less puberulous without, glabrescent within, the inferior median lobe 9.5 mm. long, the other lobes about 5 mm. long; stamens exserted, the filaments about 6.5 mm. long, hairy-puberulous at the base, glabrous above; anther cells strongly divaricate; ovary subglobose, glabrous except around the base of the style, this glabrous, equaling the stamens.

Drupe about 7 mm. long, glabrous, 2-seeded, bearing at the base the patelliform accrescent calyx.

SPECIMEN EXAMINED:

VENEZUELA: Sacupana, Orinoco Delta, flowers and fruit, April, 1896, *Rusby & Squires* 84, 257.

Distributed under the name of *Vitex cymosa* Bertero, but clearly the same plant as the one reported from Trinidad, which is situated in front of the Orinoco Delta and has a very similar flora.

CUCURBITACEAE.

THE SPECIES OF CALYCOPHYSUM.

The genus *Calycophysum*, established in 1854 by José Triana¹¹ upon specimens collected in the valleys of Cauca and Magdalena, Colombia, is closely related to *Sicana*, from which it differs mainly

¹¹ Nuevos géneros i especies de plantas 20. 1854.

in its inflated calyx and in the presence in the staminate flower of a trilobate pistillodium. The latter character, however, is not mentioned in the descriptions of the known species and apparently does not exist in the only flower I have been able to dissect.

The type species, *C. pedunculatum* Triana, is known only from the middle belt of Colombia, at altitudes of 850 to 1,500 meters, with a possible extension to Ecuador. This species was cultivated by Naudin in the gardens of the Museum at Paris and by the brothers Huber at Hyères, and produced at the latter place male flowers from which a published illustration¹² was made. From this illustration it may be seen that the calyx segments, of which Cogniaux gives only the dimensions, are broadly rounded-triangular, and that the corolla has very short lobes and is slightly longer, or at least not shorter, than the corolla.

In my recent explorations in Venezuela it was my good fortune to obtain specimens which at first seemed to agree very satisfactorily with the descriptions of *C. pedunculatum*, but which, on closer examination, were found to differ in general pubescence, length of the peduncles, and shape of the calyx and corolla, as well as in certain other details. These specimens are described below under the name *C. brevipes*, and photographic illustrations also are given.

As a variety *villosum*, Cogniaux¹³ described a collection made by Miguel Bang in Bolivia (no. 2244). The specimens are seemingly immature; but besides the characteristic indument of the petioles and peduncles, which are both remarkably stout, the calyx is larger and of a distinct shape and texture, and as the locality of the plant is far distant from that of typical *C. pedunculatum*, it may be inferred that the Bolivian specimens really represent another specific type, to be known as ***Calycophysum villosum*** (Cogn.) Pittier.

A third form, *C. gracile* Cogn.,¹⁴ has been described from the lower Magdalena Valley in Colombia. This is said to differ from the type species in the longer subulate teeth of the leaf margin, in the color of the calyx, the segments of which are shorter and narrower, and in the longer corolla. This difference in the length of the corolla, which, if constant, would form perhaps the best distinction between the two species, should, however, be considered cautiously. From observations upon the living Venezuelan plant I am inclined to believe that in the mature stage of the flower the corolla is in all cases longer than the calyx and Naudin's illustration, cited above, shows that in *C. pedunculatum* the corolla is at least equal to the calyx. The size and shape of the calyx and corolla, the length of the stamens, and the leaf characters seem better to differentiate the two species.

¹² Ann. Sci. Nat. IV. Bot. 18:185. pl. 9. 1862.

¹³ *Calycophysum pedunculatum villosum* Cogn. Bull. Torrey Club 23:17. 1896.

¹⁴ Bull. Acad. Sci. Belg. II. 49:191. 1880.

In the National Herbarium there is one specimen, with male flower, of another *Calycophysum* collected in Santa Marta, Colombia, by Herbert H. Smith (no. 1603). This is labeled *C. pedunculatum*, but it so far disagrees with the description of that species, as well as with that of *C. gracile* and with my own plant, that there is little doubt that it represents a new species. It is here described as *C. cordatum*.

We may, then, recognize at the present time at least five species of *Calycophysum* which may be distinguished by the following key:

Leaves cordate; filaments 2 cm. long-----*C. cordatum* Pittier.

Leaves subtrilobate; filaments much shorter.

Calyx not over 3 cm. long, the segments narrow. Filaments 5 to 7 mm. long-----*C. gracile* Cogn.

Calyx more than 3 cm. long.

Segments of the calyx broad and somewhat rounded.

C. pedunculatum Triana.

Segments of the calyx narrow and acuminate.

Petioles and peduncles tomentose-pubescent-----*C. brevipes* Pittier.

Petioles and peduncles villous-tomentose with long hairs.

C. villosum (Cogn.) Pittier.

Calycophysum cordatum Pittier, sp. nov.

A vine, the stems glabrous or glabrescent. Leaves membranous, the petioles terete, 4 cm. long, minutely tomentose-pubescent, the blades cordate, short-acuminate, 8 to 10 cm. long, 9 to 11 cm. broad, remotely subulate-denticulate, light green and sparsely pubescent above, densely pubescent beneath, the basal sinus about 2 cm. deep and 1 cm. broad, subrectangular.

Staminate flowers solitary in the axils of the leaves; peduncles 9 to 12 cm. long, tomentose-pubescent, rather slender; calyx broadly campanulate, 3.5 to 4 cm. long, minutely grayish-tomentose, the lobes narrow, long-acuminate, 2 to 2.5 cm. long; corolla narrowly campanulate, glabrous, yellowish, longitudinally purplish-veined, with a broad purple spot at the base, 4 to 4.5 cm. long, the segments 2.5 to 3 cm. long, about 12 mm. broad, rounded-subacute at the apex; stamens 3, the filaments glabrous, 2 cm. long, the anthers 1 cm. long; pistil-lodium apparently none.

Pistillate flower and fruit not known.

Type in the U. S. National Herbarium, no. 533953, collected in Santa Marta, Colombia, altitude 2,000 meters, January, 1900, by H. H. Smith (no. 1603).

Calycophysum brevipes Pittier, sp. nov.

PLATES 27-30.

A robust vine, subligneous and up to 7 cm. thick at the base, ramose, the branchlets angular, sulcate, villous or villosulous. Leaves membranous, light green and more or less pilosulous above, pale green and densely tomentose-pubescent beneath, the petioles 3 to 4 cm. long, tomentose-pubescent, the blades subtrilobate, 7 to 18 cm. long, 10 to 14 cm. broad, the lateral lobes rounded or subacute, the median lobe longer, triangular, acute, the basal sinus rather narrow, rounded, 1.5 to 2.5 cm. deep, 1 to 2 cm. broad; tendrils 3 or 4-branched, stout, more or less tomentose, the petiolar part 1 to 4 cm. long.

Flowers solitary in the axils, the peduncles and calyx tomentose; calyx 3.5 long, the segments 2.5 to 3 cm. long, 10 to 12 mm. broad at the base, acuminate; corolla pale reddish white, about 4.2 cm. long, the lobes reflexed, subobtuse at the apex, 5 to 7-ribbed, more or less pubescent on the ribs without, 1.5 to 2 cm. long, 6 to 7 mm. broad at the base. Male flowers immature, the peduncles

up to 10 cm. long. Pistillate flowers with stout peduncles 6 to 7 cm. long; staminodia not seen; ovary ovoid-cylindric, pubescent, 4.5 cm. long; style 2.5 cm. long, erect, glabrous; stigmas 3, distinct at the base, connivent at the apex and expanded into broad spreading subentire lobes.

Fruit indehiscent, ovoid, stipitate, glabrous, orange-yellow with lighter stripes and lines without, 12 to 15 cm. long, 7 to 9 cm. in diameter, the stipe 1.5 to 2 cm. long, 1.5 cm. thick, the peduncles thick, glabrous, up to 8 cm. long; seeds numerous, immersed in a copious watery white pulp, depressed, brownish with dark spots, 1 cm. long, about 5 mm. broad at the middle and not over 2 mm. thick, subnaviculiform, with one end subacute and narrow, the other broad and rounded.

Type in the U. S. National Herbarium, no. 987505, collected at the forest edge, upper slopes of Cotiza, near Caracas, Venezuela, altitude 1,400 to 1,700 meters, flowers and fruits, in September and November, 1917, by H. Pittier (no. 7381). Also collected in the same region, in staminate flower (*Pittier* 7571).

The fruits of this species, which are called "parcha de culebra," are rather ornamental. The pericarp turns hard at maturity. When the pulp surrounding the seeds is eaten, it tastes at first very sweet but later produces in the mouth and digestive canal an intense and painful burning sensation, accompanied by nausea and a rapid rise of temperature.

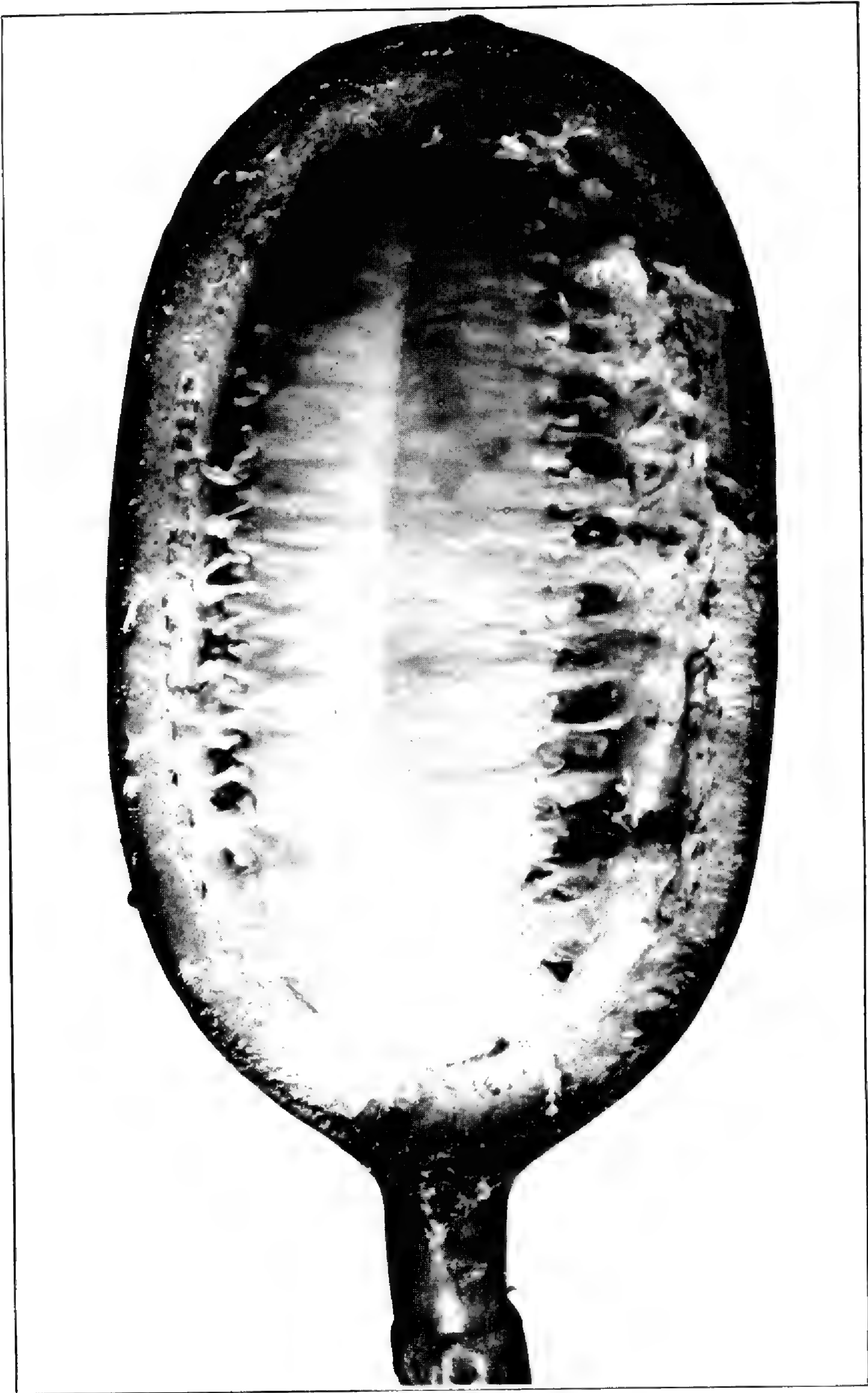
EXPLANATION OF PLATES 27-30.—*Calycophysum brevipes* Pittier. Natural size.



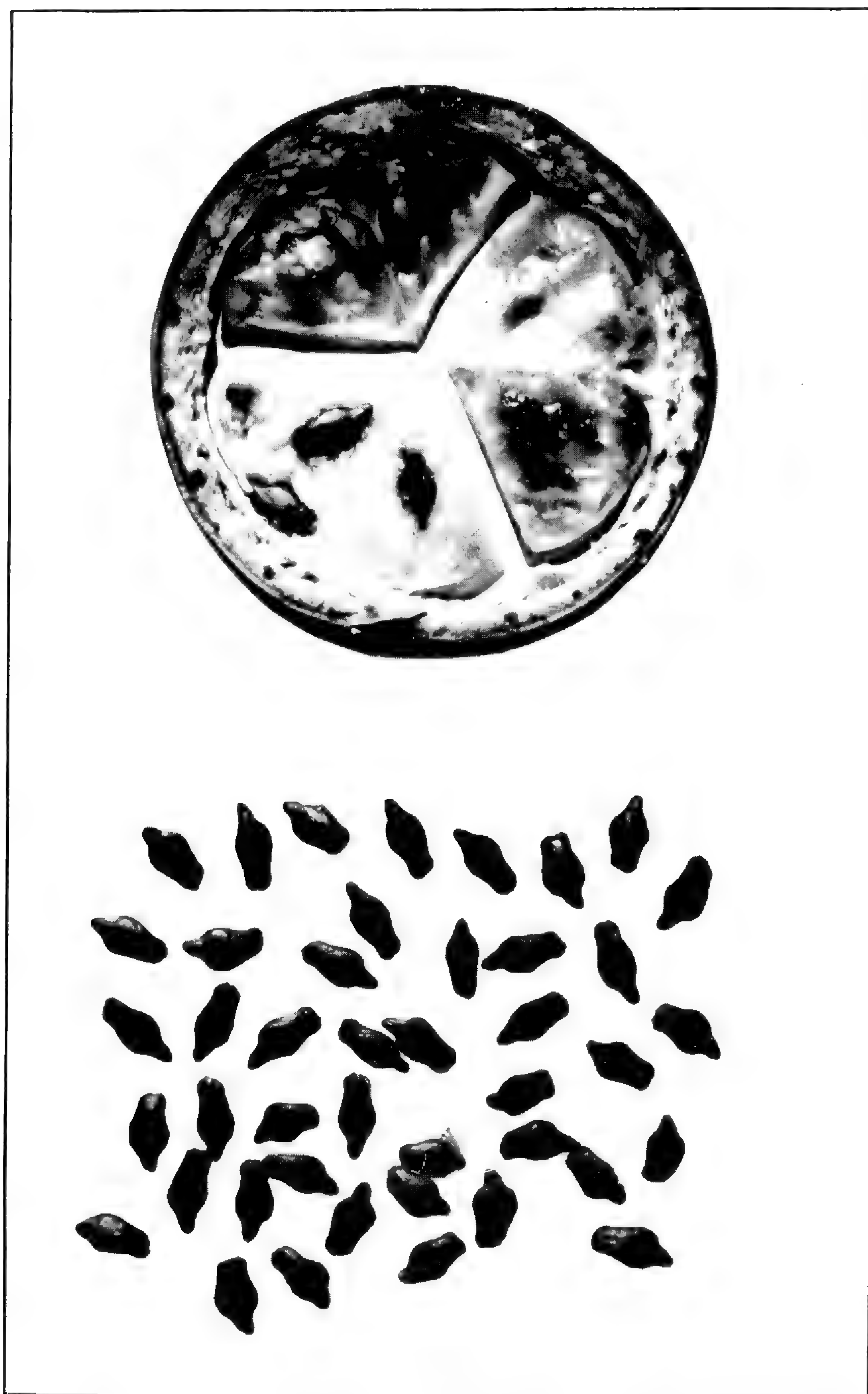
CALYCOPHYLLUM BREVIPES PITTIER.



CALYCOPHYSUM BREVIPES PITTIER.



CALYCOPHYSUM BREVIPES PITTIER.



CALYCOPHYSUM BREVIPES PITTIER.

REVISION OF THE AMERICAN SPECIES OF RINOREA.

By S. F. BLAKE.

INTRODUCTION.

With the exception of *Viola* and *Hybanthus*, the genus *Rinorea* contains more American species than any other genus of Violaceae, and in the world at large it ranks next to *Viola* in number of species. One hundred four African species are listed by De Wildeman in a recent paper, and others occur in tropical Asia, Madagascar, and the Mascarene Islands. The variation in minor details of structure of the stamens, particularly in the species of the Old World, led to the proposal of a number of genera by earlier authors. The genus was first taken in essentially its modern sense by Robert Brown,¹ who used for it the name *Alsodeia* of Thouars, based on a species of Madagascar. The earlier name *Rinorea* of Aublet, adopted by Bailon in 1873 and by Kuntze in 1891, is now in practically universal use for the genus.

The species of *Rinorea* are shrubs or trees, with alternate or apparently opposite, or very rarely ternate, leaves, and axillary or sometimes terminal racemes, panicles, or cymes of small white or yellowish flowers. The genus is characterized by its regular flowers, with five free petals, and 3-valved capsule. In nearly all the American species the stamens are entirely free, and the connectives are dilated dorsally from base to apex into scarious brownish scales exceeding the anthers and free from them laterally and apically. In nearly all the American species, also, each filament is adnate outside at the base or throughout its length to a gland, which is sometimes longer than the filament and is usually free at apex. In a few species the filaments are borne on the inner side of a sometimes 5-lobate disk.

In *R. dichotoma*, of Colombia, the broad filaments are united for about two-thirds their length into a cup, and the connectives are dilated into a brownish scale only at the apex. This species also differs in its inflorescence from all other American species I have examined, the flowers being in short, dense, once or twice dichotomous cymes. Two related species, *R. andina* and *R. gossypium*, are

¹ In Tuckey, Narr. 440. 1818.

described from Colombia, with the same type of inflorescence and connective. Distinct as these species are in appearance, they are matched in their more important stamen characters by various species of the Old World.

In some species the anthers sacs bear at the apex one or two scarious cusps, sometimes nearly as long as the sacs; in one or two others they bear a few filiform setae. Although the presence or absence of these cusps has been considered of importance, and undoubtedly is so, I have not found it of sufficient constancy in the material examined to be of much use as a key character. Certain species, it is true, never possess these cusps, but in others in which they occur they may be found in one flower dissected, or on some anthers only, and may be absent in others from the same specimen. It may be that they are deciduous or easily broken off; but when found at all in dissected material they do not appear especially fragile, and I am unable to explain their irregular occurrence. In consequence, I have avoided in so far as possible the use of the presence or absence of these appendages as a character in the key, and when its use has seemed unavoidable have made provision under both headings for those species in which variation has been found in my dissections.

Rinorea is distinguished from *Hybanthus* (taken in its broad sense to include *Ionidium*, incorrectly called *Calceolaria* by some modern American authors²) by its regular flowers. Those of *Hybanthus* always show at least a slight enlargement of the keel petal and so far as the North American species of *Hybanthus* are concerned, at any rate, may also be distinguished by the fact that the anthers or connective scales of at least some of the stamens are connate. The sepals of *Rinorea* are generally described as equal, but this is not true of all the species. In *R. sylvatica*, for example, the two outer sepals are larger than the others and thicker; but all are similar in form, and the passage from the largest and thickest outer sepal to the smallest and thinnest innermost is gradually effected through the intermediate sepals.

²The genus *Calceolaria* of the Scrophulariaceae was founded by Linnaeus filius in 1771. Unfortunately, the name had already been used three times previously in botany. Its first publication by Loeffling (*Iter Hisp.* 183) in 1758 is invalid according to the American Rules, since no truly binominal species was included, the name *Calceolaria frutescens* used for Loeffling's third species being merely a chance binomial having no relation to the Linnaean binomial system. As used by American authors for the group of species sometimes separated from *Hybanthus* under the more commonly used name *Ionidium* Vent. (1800), it dates from the German edition (1766) of Loeffling's work, by Koelpin, in which binomial equivalents are given for Loeffling's three polynomial species. This use of the name is not valid under the American Code, since Fabricius in 1763 (*Enum. Pl. Hort. Helmst.* ed. 2, 37) had properly published a genus *Calceolaria* based on *Cypripedium calceolus* of Linnaeus.

The flowers of several species are known to be fragrant, and this is probably true of all. The capsules, when boiled, give forth the characteristic odor of slippery elm (*Ulmus fulva*), and this is sometimes apparent in the dried specimens.

The only treatment of the American species which is of any value in the determination of specimens is that of Eichler (1871) in the *Flora Brasiliensis*, and in this only 11 species are described, while the number of species now known from America is about 39. Of these, I have been able to examine 25, of which 16 or 17 are represented by types or by specimens or fragments of the type collections. In addition to the material in the U. S. National Herbarium, that in the Gray Herbarium and the herbarium of the New York Botanical Garden has been examined, through the kindness of the curators, and Dr. Otto Stapf has forwarded single flowers from the types of four of Bentham's species in the Kew Herbarium. Mr. E. G. Baker, of the British Museum (Natural History), has sent drawings of Aublet's types and notes which have been of great assistance in settling the identity of three species described by Aublet under as many generic names.

The status of most of the American species can now be regarded as definitely established. In several cases, however, it will be necessary to examine original specimens or more extensive series before the validity of some forms can be regarded as decided. Closely related pairs of species are *Rinorea dichotoma* and *R. andina*, *R. guianensis* and *R. paniculata*, *R. hymenosepala* and *R. ulmifolia*, *R. pubipes* and *R. squamata*. *Rinorea brevipes* may yet prove to intergrade with *R. passoura*, as may *R. pilosula* with *R. guatemalensis*. *Rinorea gracilis* is known only from fruiting material, like several apparently new species of which I have seen specimens in herbaria, but which I have omitted, since their description from fragmentary material would serve merely to swell the list of doubtful species without adding to our knowledge of the group.

In this revision the genus is taken in the limits given it by Bentham and Hooker, which were followed by Taubert in the *Pflanzenfamilien*. The fact that the apparently opposite leaves of *Rinorea* are not morphologically so has been demonstrated by Eichler,³ but for brevity's sake I have described the leaves in these species as opposite. All measurements of floral details are taken from boiled parts spread flat. In the case of the petals the measurements are often considerably greater than they appear in pressed specimens, since the tips are reflexed in nearly all the species. The descriptions of staminal details are based in nearly every case on repeated dissections. The measurements given for length of anthers apply to

³ In Mart. Fl. Bras. 13¹: 384. 1871.

the anther sacs only and do not include appendages. Except where otherwise indicated, all descriptions are based entirely on specimens examined. The following abbreviations are used in referring to herbaria in which specimens are deposited: G, Gray Herbarium; N, U. S. National Herbarium; Y, herbarium of the New York Botanical Garden.

No species of *Rinorea* is known to be of much economic importance, although a few are used by natives for one purpose or another. To this fact, as well as to a lack of striking features in habit or color, is due their comparative paucity of vernacular names. The only American species for which I have been able to find native names and uses recorded are listed here.

Rinorea physiphora, of the Rio de Janeiro region, is known as "lobolobo," and the leaves are said to be boiled and eaten as greens by negroes, a use for which they seem singularly unfitted. St. Hilaire, however, was of the opinion that the species might be improved and made of some importance by cultivation. Baillon states that the astringent bark of the same species is used as a febrifuge. The native name of *R. riana* in Colombia is given as "jazmin," and in Venezuela as "rabo de cachicamo" and "tabaquito." The names "conohorié" and "jacamim-renepea" are given for *R. flavescens*. *Rinorea hummelii* is known in British Honduras as "wild coffee."

SYSTEMATIC TREATMENT.

Flowers in forked cymes 10 to 15 mm. long; connectives dilated into a scarious scale only at apex; placentae about 12-ovulate or more, the ovules 3 to 6-seriate.

Pedicels 8 to 14 mm. long; leaves 3.5 to 5 cm. wide; connective scales ovate.

Connective scales acute, erose; anther cells 1 mm. long----- 1. *R. andina*.

Connective scales obtuse, 3 or 4-denticulate; anther cells 2 mm. long.

2. *R. dichotoma*.

Pedicels 5 mm. long; leaves 5 to 10 cm. wide; connective scales linear-oblong-----

3. *R. gossypium*.

Flowers in usually longer racemes or panicles; connectives scarious-dilated and free laterally from the very base; placentae 1 to 4-ovulate, the ovules 1-seriate.

Leaves alternate.

Flowers racemose-paniculate.

Connective scales lance-ovate, narrowed to apex.

Petals little longer than calyx; connective scales somewhat barbate outside toward base----- 4. *R. paniculata*.

Petals twice as long as calyx or longer; connective scales glabrous.

Leaves essentially entire; ovary villosulous at apex. 5. *R. bahiensis*.

Leaves distinctly crenate-serrate; ovary densely hispid-pilose.

6. *R. guianensis*.

- Connective scales oval or oblong, broadly rounded.
- Ovary glabrous..... 7. *R. crenata*.
- Ovary densely pubescent..... 15. *R. hymenosepala*.
- Flowers strictly racemose.
- Leaves cordate at base..... 8. *R. maximiliani*.
- Leaves narrowed at base..... 9. *R. physiphora*.
- Leaves opposite, very rarely ternate.
- Flowers racemose-paniculate, forming a narrow thyse.
- Ovary glabrous.
- Petals 2.6 mm. long; leaves short-pointed, green beneath.
..... 10. *R. racemosa*.
- Petals 3.2 to 3.5 mm. long; leaves long-attenuate, glaucescent beneath.
..... 11. *R. sprucei*.
- Ovary pubescent.
- Axis of inflorescence glabrous..... 12. *R. lindeniana*.
- Axis of inflorescence pubescent or puberulous.
- Petals 2 to 3 mm. long.
- Filaments bearing a gland at apex; petals glabrous or only obscurely ciliolate, 2.5 to 3 mm. long..... 13. *R. riana*.
- Filaments bearing a gland at base; petals ciliolate, 2 mm. long.
..... 14. *R. micrantha*.
- Petals 4 to 5.2 mm. long.
- Sepals 2 to 3 mm. long; leaves pubescent at least on the veins beneath; placentae 1-ovulate.
- Connective scales erose; anthers with comparatively large terminal appendages; filaments bearing a gland.
..... 15. *R. hymenosepala*.
- Connective scales entire; anthers unappendaged; filaments eglandular..... 16. *R. ulmifolia*.
- Sepals 1 to 1.2 mm. long; leaves glabrous beneath; placentae 2-ovulate..... 17. *R. hummelii*.
- Flowers strictly racemose.
- Petals only once and a half as long as sepals, or less.
- Leaves puberulous and strigose on veins beneath; sepals hispid; filaments not bearing a gland; anthers 1-mucronate or unappendaged.
..... 18. *R. sylvatica*.
- Leaves glabrous; sepals puberulous; filaments bearing a gland at apex; anthers multisetose 19. *R. martini*.
- Petals more than once and a half as long as sepals, usually twice as long or more.
- Ovary glabrous or rarely with a few hairs..... 20. *R. flavescens*.
- Ovary densely pubescent.
- Anthers bearing at apex 1 or 2 cusps or mucros, or 1 to several setae.
- Petals pubescent dorsally..... 21. *R. passoura*.
- Petals glabrous or merely ciliolate, rarely with a few hairs on back.
- Connective scales strongly erose or crisped below; placentae 1-ovulate..... 22. *R. guatemalensis*.
- Connective scales entire or merely obscurely erose; placentae usually 2 to 4-ovulate (1-ovulate in *R. brevipes* and *R. deflexa*).
- Leaves strongly coriaceous, strictly entire, with strongly thickened margin 23. *R. marginata*.

Leaves papery to coriaceous, serrulate to dentate.

Filaments 0.4 mm. long, about one-fifth as long as anthers;
anthers much more than half as long as connective
scales----- 24. *R. brachythrrix*.

Filaments 0.6 to 1 mm. long, half as long as anthers;
anthers about half as long as connective scales, or less.

Leaves coriaceous, sharply serrulate, densely prominulous-
reticulate on both sides----- 25. *R. melanodonta*.

Leaves papery to pergamentaceous, obscurely serrulate
or obtusely dentate, not densely prominulous-retic-
ulate.

Petals 4 mm. long, glabrous; leaves falcate-acuminate.

26. *R. falcata*.

Petals 4.5 to 6 mm. long, ciliate or cillolate at least
at apex; leaves obtusely short-pointed.

Sepals thick, strongly striate; petals cillolate-tufted
at apex----- 27. *R. brevipes*.

Sepals thin, not strongly striate; petals short-ciliate.

28. *R. deflexa*.

Anthers not appendaged at apex.

Filaments 0.3 mm. long, about one-eighth as long as the connective
scales----- 29. *R. ovalifolia*.

Filaments 0.4 to 1.5 (usually 0.7 to 1) mm. long, one-fifth to two-
thirds as long as the connective scales.

Flowers subsessile; capsule 4 to 5 cm. long- 30. *R. macrocarpa*.

Flowers distinctly pedicellate; capsule (not known in all the
species) 2 cm. long or less.

Filaments nearly or quite as long as anther cells.

Leaves 4 to 6 cm. long; connective scales entire.

31. *R. juruana*.

Leaves 6 to 23.5 cm. long; connective scales erose.

Leaves 6 to 11.5 cm. long; placentae 1-ovulate.

32. *R. viridifolia*.

Leaves 13 to 23.5 cm. long; placentae 2-ovulate.

Leaves oblong or ovate-elliptic; connective scales lance-
ovate----- 33. *R. scandens*.

Leaves obovate; connective scales elliptic-oblong.

34. *R. deflexiflora*.

Filaments one-half or rarely two-thirds as long as anther cells,
or less.

Connective scales distinctly erose.

Petals about 3 mm. long----- 13. *R. riana*.

Petals 5.5 mm. long----- 22. *R. guatemalensis*.

Connective scales entire or merely obscurely erose chiefly
below.

Filaments about twice as long as the glands; sepals 2.4 to
2.7 mm. long----- 27. *R. brevipes*.

Filaments not twice as long as, sometimes shorter than, the
glands; sepals 1.2 to 2 mm. long.

Filaments more than half as long as anther cells; con-
nective scales 2.2 mm. long.

Leaves hispid-pilose and densely puberulous on the
veins beneath; connective scales ovate.

35. *R. pubipes*.

Leaves strigose or hispid-pilose, but not puberulous,
on the veins beneath; connective scales oval-
oblong----- 36. *R. squamata*.

Filaments not half as long as the anther cells; connec-
tive scales 2.8 to 3.5 mm. long.

Stamens 3.5 mm. long, the filaments exceeding the
glands----- 28. *R. deflexa*.

Stamens 3.8 to 4.2 mm. long, the glands exceeding the
filaments----- 37. *R. pilosula*.

1. *Rinorea andina* (Tulasne) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

Alsodeia andina Tulasne, Ann. Sci. Nat. III. Bot. 7: 366. 1847.

Tree, glabrous; leaves alternate; petioles 5 mm. long; blades ovate-lanceo-
late or lanceolate, 10 to 15 cm. long, 4 to 5 cm. wide, acute or acuminate, acute
at base, obscurely serrulate; cymes twice bifid, 4-flowered, 1 cm. long; pedicels
1 cm. long; sepals suborbicular, very obtuse, the inner broader and thinner;
corolla thrice as long as calyx, the petals elliptic-ovate, 8 mm. long, acute,
deflexed at apex; stamens 3 mm. long, the filaments short, broad, bearing a
gland at apex, connate below into an annulus, alternating with minute teeth, the
anthers obtuse, about 1 mm. long, not appendaged, each connective dilated at
apex into an ovate, acute, somewhat erose scale; ovary glabrous, the placentae
bearing numerous 3 to 6-seriate ovules; fruit oblong-fusiform, 3 cm. long; seeds
numerous, glabrous.

TYPE LOCALITY: Near La Trocha, in the Cordillera Central of Colombia.
Type in the herbarium of the Jardin des Plantes, collected by Goudot (no 138).

Not seen; description condensed from that of Tulasne. M. Gagnepain of the
Paris Herbarium has kindly communicated notes on the petals and the struc-
ture of the stamens.

2. *Rinorea dichotoma* Rusby, Descr. New So. Amer. Pl. 61. 1920. PLATE 31.

Tree; branchlets glabrous; leaves alternate; petioles glabrous, 3 to 6 mm.
long; blades elliptic or oblong-elliptic, 10 to 14 cm. long, 3.5 to 5 cm. wide,
obtusely acuminate, cuneate at base, remotely repand-serrulate, glabrous,
papery, the lateral veins about 8 pairs, the secondaries loosely prominulous-
reticulate; peduncles glabrous, axillary, about 4 mm. long; cymes 8 to 12
mm. long, once or twice bifid, the branches densely covered with small ciliolate
persistent bracts and the pedicels of fallen flowers, bearing at apex 1 or 2
flowers; pedicels glabrous, 8 to 14 mm. long; sepals orbicular, 1.8 to 2.4 mm.
long, broadly rounded, slightly fleshy, ciliolate, not evidently nerved; petals
white, oblong-ovate, 9 mm. long, obtuse, slightly spreading at apex, obscurely
ciliolate below; stamens 3.8 mm. long, the filaments very broad, 0.8 mm. long,
connate for two-thirds their length, glabrous, bearing at apex a fleshy rounded
gland 0.3 mm. long, the anthers oblong-ovate, 2 mm. long, not appendaged, each
connective dilated at apex into an ovate obtuse brownish scale, this 3 or 4-den-
tulate at apex, obscurely erose toward base; ovary glabrous, ovoid, the placen-
tae about 12-ovulate, the ovules about 3-seriate.

TYPE LOCALITY: Above Valparaiso, Colombia.

SPECIMENS EXAMINED:

COLOMBIA: Above Valparaiso, vicinity of Santa Marta, altitude 1,525
meters, 1898-99, *Herbert H. Smith* 1492 (type; Y, photograph N).

This species with *R. andina* and *R. gossypium* forms a small group very
different from all other American species in their comparatively large flowers
in dense, once or twice bifurcate cymes, with the filaments connate into a
ring below, the connectives dilated into scales only at apex above the tips
of the anthers, and the ovules very numerous and several-seriate. Distinct

as this group seems in these characters, in several of which it approaches the genus *Gloeospermum*, it is connected with the more typical forms by numerous species of the Old World. The present species is close to *R. andina*, which I know only from description, but appears to differ in definite staminal characters. The description of the stamens in the original characterization of *R. dichotoma* is incorrect in almost every particular.

EXPLANATION OF PLATE 31.—*Rinorea dichotoma*, from the type specimen. Natural size.

3. *Rinorea gossypium* (Tulasne) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

Alsodeia gossypium Tulasne, Ann. Sci. Nat. III. Bot. 7: 367. 1847.

Tree, glabrous; leaves alternate; stipules 15 mm. long; petioles 5 to 8 mm. long; blades broadly elliptic or elliptic-oblong, 12 to 18 cm. long, 5 to 10 cm. wide, short-acuminate, rounded at base, subentire; cymes 15 mm. long, several times branched, 3 to 10-flowered; pedicels 5 mm. long; sepals ovate, obtuse, marcescent; petals (in bud) exceeding the sepals, ovate-oblong, obtuse; filaments united into an annulus, short, with a gland at base, alternating with 5 teeth of the annulus, the anthers oblong, the connective scales terminal, oblong-linear, obtuse; ovary glabrous, the ovules numerous and pluriseriate on each placenta; capsule globose, 3 cm. thick, 8 to 10-seeded; seeds white-woolly, 8 mm. long.

TYPE LOCALITY: Near Muzo, eastern Andes of Colombia. Type in the herbarium of the Jardin des Plantes, collected by Goudot.

Not seen; description condensed from the original. To be distinguished from *R. andina* and *R. dichotoma* by its shorter pedicels, broader leaves, and woolly seeds. Triana and Planchon⁴ record the species from the plain of San Martín, between Villavicencio and Jiramena, Colombia, altitude 250 meters. M. Gagnepain of the Paris Herbarium has sent me sketches of this species, which show that it is properly placed in this group.

4. *Rinorea paniculata* (Mart.) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

Alsodeia paniculata Mart. Nov. Gen. & Sp. 1: 30. pl. 21. 1823.

Tree, glabrous; leaves alternate; stipules lanceolate, fugacious; petioles 5 to 10 mm. long; blades elliptic, oval-oblong, or ovate-oblong, 8 to 15 cm. long, 3 to 6 cm. wide, acuminate or short-pointed, cuneate at base, entire or subrepand; panicles (including peduncle) 6 to 9 cm. long, about 2.5 cm. wide, terminal, loose, puberulous, the branches 2 to 5-flowered; sepals broadly ovate, obtusish, puberulous and ciliolate; petals small, half longer than the calyx, white, ovate-lanceolate, obtuse, spreading at apex, somewhat puberulous outside; filaments short and broad, the anthers ovate, 2-mucronate, the connective scales about twice as long, lance-ovate, acute, serrate, somewhat barbate toward base outside; ovary villous; capsule obovoid-turbinate, about 1 cm. long, sericeous-pubescent, usually 1-seeded.

TYPE LOCALITY: Primeval woods near Teffé and Coari, Province of Alto Amazonas, Brazil. Type collected by Martius.

Not seen; description compiled from Martius. This species is close to *R. guianensis*, which Eichler united with it, but has considerably shorter petals, and, according to the original description, the connective scales are somewhat barbate outside toward base, which is not the case in *R. guianensis*.

5. *Rinorea bahiensis* (Moric.) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

Alsodeia bahiensis Moric. Pl. Nouv. Amér. 68. pl. 46. 1839.

Glabrous; leaves alternate; petioles about 6 mm. long; blades ovate-elliptic or obovate-elliptic, 4 to 7.5 cm. long, 2.5 to 3.5 cm. wide, obtuse to short-acuminate, at base acute, subentire; panicles terminal, narrow, puberulous,

⁴ Ann. Sci. Nat. IV. Bot. 17: 126. 1862.

5 to 9 cm. long, the branchlets mostly 3 to 7-flowered; sepals ovate, 2.5 mm. long, obtuse, puberulous; petals twice as long as the sepals, ovate, narrowed to an obtusish apex, ciliolate and dorsally puberulous; stamens shorter than petals, the filaments broad, very short, bearing a gland at base, the anthers 2-mucronate, the connective scales twice as long, ovate, narrowed to an obtusish apex, glabrous; ovary villosulous at apex.

TYPE LOCALITY: Bahia, Brazil. Types collected by Blanchet (nos. 1476, 1496).

Not seen; description compiled from the original and from Eichler. Eichler describes the leaves as 4 to 5 cm. long, but in the original they are described and figured as $1\frac{1}{2}$ to 3 inches long. The species is close to *R. guianensis*, but may be distinguished by its smaller essentially entire leaves.

6. *Rinorea guianensis* Aubl. Pl. Guian. 1: 235. pl. 93. 1775.

Conohoria rinorea St. Hil. Mém. Mus. Hist. Nat. 11: 495, excluding synonyms in part. 1824.

Alsodea rinorea Spreng. Syst. Veg. 1: 807. 1825.

Alsodeia floribunda Moric. Pl. Nouv. Amér. 70. pl. 47. 1839.

Alsodeia castaneaefolia Eichl. in Mart. Fl. Bras. 13¹: 382. 1871. Not *Conohoria castanefolia* St. Hil., 1824.

Shrub or tree; branches strigillose, glabrate; leaves alternate; petioles 5 to 8 mm. long, strigillose, glabrate; blades elliptic to oval or oblong-ovate, 7 to 15 cm. long, 2.5 to 5 cm. wide, acuminate or short-pointed but obtuse, at base cuneate to rounded-cuneate, subcoriaceous, crenate-serrate, strigose on costa and sometimes on veins beneath; panicles axillary, about 6 cm. long and 2 cm. wide, rufig-puberulous, the branches 3 to 5-flowered; sepals ovate or oval, 1.5 to 2 mm. long, obtuse, apiculate dorsally below the apex, ciliolate and puberulous; petals lance-ovate, 5 mm. long, obtuse, puberulous along midline, recurved at apex; stamens 3.3 mm. long, the filaments broad, 0.3 mm. long, bearing at base a fleshy triangular gland, the anthers 1.2 mm. long, bearing at apex 1 or 2 cusps 0.8 mm. long or less, the connective scales ovate, 3 mm. long, narrowed to an obtuse apex, glabrous; ovary densely hispid-pilose, the placentae 1-ovulate; "capsule oblique, 9 mm. long, tomentellous, 1-seeded; seed glabrous."

ILLUSTRATIONS: Aubl. Pl. Guian. pl. 93; Moric. Pl. Nouv. Amér. pl. 47; Mart. Fl. Bras. 13¹: pl. 77, f. 3 (fruit).

TYPE LOCALITY: Region of Caux, French Guiana. Type, collected by Aublet, in the British Museum.

SPECIMENS EXAMINED:

FRENCH GUIANA: Region of Caux, Aublet (sketch of type; N).

BRAZIL: Province of Bahia, Blanchet 1626 (type collection of *A. floribunda*; Y, photo. N). Monte Corcovado, near Rio de Janeiro, 1839, Martius 471 (Y). Without definite locality, Riedel (G, N, Y).

Eichler used for this species the name *Alsodeia castaneaefolia*, based on *Conohoria castanefolia* St. Hil., and indicated by a sign of affirmation that the name was authenticated by specimens. Study of St. Hilaire's descriptions, however, indicates that this course is probably incorrect. *Conohoria castanefolia* was originally described in connection with *Conohoria lobolobo* (now *Rinorea physiphora*), a species with simple racemes, and was distinguished from that species by its broader, manifestly serrate, mucronulate leaves, its larger flowers, more pubescent pedicels, and very villous ovary with suspended ovules. In his memoir on the family, published in the same year, St. Hilaire⁵ described three species: *Conohoria lobolobo* (of which *A.*

⁵ Mém. Mus. Hist. Nat. 11: 495. 1824.

physiphora Mart. was given as a synonym), *C. castanaefolia*, and *C. rinorea*. The racemes in the first two species were described as simple, resembling those of the lily-of-the-valley, and the leaves as crowded at the tips of the branchlets. The third species, *Conohoria rinorea*, was described as with compound racemes and alternate, rather remote leaves, and to its synonymy were referred *Rinorea guayenensis* [sic] Aubl. and *Alsodea paniculata* Mart. Eichler himself refers this third name of St. Hilaire (*Conohoria rinorea*) to his own *A. castanaefolia*, a species characterized by its paniculate flowers, scattered (not crowded) leaves, and petals considerably longer than the sepals. *Conohoria castanaefolia*, described as with simple racemes and leaves crowded at the tips of the branches, is considered synonymous. This course is contrary to St. Hilaire's description; and since he showed a clear appreciation of the characters of most significance in this group, it seems necessary to follow his descriptions rather than the views of Eichler. The differences between *C. lobolobo* and *C. castanaefolia* indicated by St. Hilaire do not seem to be of any real consequence, and both are described from the vicinity of Sao Sebastião, so that their reference to the synonymy of *Rinorea physiphora* seems justified.

I have not been able to find any difference of importance indicated by the description of *R. guianensis*, when compared with an authentic specimen of *Alsodeia floribunda* Moric., and Mr. E. G. Baker, who has compared the still existent type of Aublet's species with material of *A. floribunda* which I sent him, has likewise not discovered any difference between them. Consequently, in spite of the considerable gap in the ranges as now known, the two names are here considered to refer to one species.

7. *Rinorea crenata* Blake, sp. nov.

Branchlets glabrous; leaves alternate; petioles minutely hirtellous, 4 to 7 mm. long; blades oblong-obovate, rarely elliptic-obovate, 8 to 13.5 cm. long, 2.5 to 5 cm. wide, short-pointed with obtuse mucronulate apex, rounded at base, crenate-serrate with obtuse teeth, papery, glabrous above, beneath paler green, minutely hirtellous beneath along the costa and the 5 or 6 pairs of lateral veins, prominulous-reticulate on both sides; panicles axillary, 1 to 3, puberulous, about 4 cm. long (including the short peduncle), about 1 cm. wide, the lower branchlets 3-flowered, the upper 1-flowered; bracts and bractlets minute; pedicels about 2 mm. long; sepals oval, 1.2 mm. long, rounded, very thin, 3-nerved, cillolate, somewhat puberulous at base; petals oval, 3 mm. long, rounded, cillolate nearly to apex, scarcely reflexed; stamens 2.1 mm. long, borne on the inner side of a repandly 5-lobed cillate disk (composed of the united glands of the filaments?), the free portion of the filaments slender, 0.4 mm. long, the anthers roundish, 0.8 mm. long, sometimes bearing at apex 1 or 2 ligulate appendages 0.4 mm. long or less, the connective scales oblong-oval, 1.7 mm. long, rounded, erose-lacerate, pilose on back below; ovary and style glabrous; placentae 1-ovulate.

Type in the U. S. National Herbarium, no. 935868, collected in forests of Shirores, Talamanca, Costa Rica, altitude about 100 meters, February, 1895, by H. Pittier and A. Tonduz (no. 9183).

Readily distinguished among North American species by its alternate leaves, paniculate inflorescence, and glabrous ovary.

8. *Rinorea maximiliani* (Eichl.) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

Alsodeia maximiliani Eichl. in Mart. Fl. Bras. 13¹: 381. pl. 77, f. 1. 1871.

Shrub 2.5 meters high, hirtellous, glabrescent; leaves alternate; petioles 1 to 2 mm. long; stipules lance-subulate, 4 to 5 mm. long, persistent; blades oblong-obovate, 8 to 12 cm. long, 3 to 4 cm. wide, obtuse or subacute, cordate at base,

subentire or remotely serrate, hirtellous, glabrescent; racemes 6 to 8 cm. long, erect, hirtellous; pedicels 4 to 6 mm. long; sepals lanceolate, 1.5 mm. long, acute, 1-nerved, puberulous; petals lanceolate, 5 to 6 mm. long, acutish, sparsely pubescent dorsally, erect; filaments much shorter than the anthers, the anthers oblong, unappendaged (according to description, but apparently figured as with 2 appendages), the connective scales about one and one-half times as long, oblong-lanceolate, obtusish, woolly on the back below; ovary villosulous, the placentae 1-ovulate.

TYPE LOCALITY: Southeastern Brazil, probably in the Province of Espiritu Santo. Type collected by Prince Maximilian von Neuwied.

Not seen; description condensed from Eichler's original. To be distinguished from *R. physiphora*, its only close ally, by its shorter-petioled leaves, with cordate bases.

9. *Rinorea physiphora* (Mart.) Baill. Hist. Pl. 4: 346. 1873.

Alsodea physiphora Mart. Nov. Gen. & Sp. 1: 28. pl. 19. 1823.

Conohoria lobolobo St. Hil. Pl. Usuell. Bras. pl. 10. 1924; Mém. Mus. Hist. Nat. 11: 494. 1824.

Conohoria castanefolia St. Hil. Pl. Usuell. Bras. under pl. 10. 1824; Mém. Mus. Hist. Nat. 11: 495, as *castaneaefolia*, 1824.

Physiphora laevigata Soland.; DC. Prodr. 1: 314. 1824.

Alsodea castaneaefolia Spreng. Syst. Veg. 4: Cur. Post. 99. 1827.

Rinorea castaneaefolia Baill. Hist. Pl. 4: 346. 1873.

Shrub or tree, 15 meters high or less, with dense spreading crown; branchlets puberulous, glabrate; leaves alternate; stipules lance-subulate, 1.5 mm. long, subpersistent; petioles 2 to 4 mm. long; blades elliptic or oblanceolate to oblong-elliptic, 6 to 10.5 cm. long, 1.5 to 3.2 cm. wide, acute, at base acutely cuneate to rounded-cuneate, remotely crenate-serrulate, becoming subcoriaceous, glabrous; racemes axillary and subterminal, 8 cm. long or less, puberulous; pedicels 2 to 5 mm. long; sepals ovate, 1.5 mm. long, acute to obtusish, ciliolate, otherwise nearly glabrous; petals white, lance-ovate, 4 mm. long, narrowed to an obtuse reflexed apex, sparsely ciliolate at apex and rarely toward base, glabrous on back; stamens 3.2 mm. long, the filaments 0.3 mm. long, exceeded by the triangular basal gland, the anthers oblong-ovate, 1.5 mm. long, bearing at apex 2 sometimes connate cusps about 0.4 mm. long, the connective scales oblong, 2.8 to 3 mm. long, obtuse, somewhat erose especially below, lanate-pilose dorsally to middle; ovary hispid-pilose, the placentae 1-ovulate; capsule very sparsely pilose, 9 mm. long, about 3-seeded; seeds glabrous, 4 mm. in diameter.

ILLUSTRATIONS: Mart. Nov. Gen. & Sp. 1: pl. 19; St. Hil. Pl. Usuell. Bras. pl. 10; Mart. Fl. Bras. 13¹: pl. 77, f. 2 (fruit); Baill. Hist. Pl. 4: f. 358-362.

TYPE LOCALITY: Near San Sebastião, Province of Rio de Janeiro, Brazil. Type collected by Martius.

SPECIMENS EXAMINED:

BRAZIL: Near Praia Grande, Rio de Janeiro, 1863, Netto (G). Rio de Janeiro, Wilkes Expedition (N). Without definite locality, Riedel (G, N, Y).

This species is apparently known only from the vicinity of Rio de Janeiro, where it is common. St. Hilaire gives its native name as "lobolobo," and states that the leaves become mucilaginous when cooked and are eaten by negroes. He believed that the plant might be improved by cultivation and become of value for food purposes, but I can find no record of any attempt to do this. According to Baillon, the bark of this species is bitter and astringent, and is used as a febrifuge.

The reasons for the reference of *Conohoria castanefolia* to the synonymy of this species are given under *R. guianensis* (no. 6).

10. *Rinorea racemosa* (Mart.) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

Alsodea racemosa Mart. Nov. Gen. & Sp. 1: 29. pl. 20. 1823.

Shrub or tree, the branchlets rufid-puberulous, glabrate; leaves opposite; petioles 3 to 10 mm. long; blades oval-oblong or elliptic-oblong, 10 to 24 cm. long, 5 to 10 cm. wide, short-pointed, cuneate at base, entire or repand, membranaceous or pergamentaceous, green on both sides, glabrous above, finely strigillose beneath; panicles subspiciform, 10 to 20 cm. long or more, about 1.2 cm. thick, obscurely puberulous, floriferous almost from the base, the cymules 3 to 6-flowered; sepals oblong to ovate, 2 mm. long, obtuse, ciliolate and puberulous; petals ovate, 2.6 mm. long, white, obtuse, scarcely recurved, slightly puberulous on middle of back; stamens 1.8 mm. long, the filaments 0.2 mm. long, the anthers 0.8 mm. long, bearing a pair of cusps fully as long, the connective scales lance-ovate, narrowed to an acutish apex, 1.6 mm. long, glabrous, serrulate; ovary glabrous, the placentae 1-ovulate; capsule 8 mm. long, trigonous-globose, 1 or 2-seeded; seeds glabrous, whitish, 3.5 mm. long.

TYPE LOCALITY: Near Lake Teffé and elsewhere on the shore of the Solimoes, Brazil. Type collected by Martius.

SPECIMEN EXAMINED:

BRAZIL: Near Panuré, on the Rio Uaupés, 1852-53, *Spruce* 2519 (G).

The above description is drawn up partly from the original and from Eichler, and partly from the single specimen examined, which is not in good condition for description. This collection (*Spruce* 2519) is referred to by Eichler as a variety with firmer, more veiny leaves and shorter racemes.

11. *Rinorea sprucei* (Eichl.) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

Alsodeia sprucei Eichl. in Mart. Fl. Bras. 13¹: 385. 1871.

Branchlets sordid-puberulous; leaves opposite; petioles 4 to 7 mm. long, incurved-puberulous; blades elliptic or elliptic-oval, 12 to 23 cm. long, 3 to 8 cm. wide, long-attenuate and cuspidulate, at base acutely cuneate, papyraceous, entire or slightly repand, above deep green, incurved-puberulous along costa and sometimes along veins, beneath paler or glaucescent, uniformly strigillose, sometimes pilose-tufted in the axils; panicles subspiciform, about 13 cm. long or less, about 12 mm. thick, rufidulous-puberulous, the cymules 3 to 6-flowered; sepals oval or ovate, obtuse, ciliolate and puberulous, 1.5 mm. long; petals ovate, 3.2 to 3.5 mm. long, narrowed to a rounded somewhat reflexed apex, puberulous along middle of back; stamens 2.8 mm. long, the filaments 0.3 mm. long, inserted inside a pubescent disk, the anthers 0.8 mm. long, not appendaged, the connective scales lance-ovate, 2.5 mm. long, narrowed to apex, entire, glabrous; ovary glabrous, the placentae 2-ovulate; "seeds 2 to each placentae, 3.5 mm. long."

TYPE LOCALITY: Along the Rio Negro and Rio Uaupés, Brazil. Types collected by *Spruce* (nos. 1834, 1947, 2633).

SPECIMENS EXAMINED:

BRITISH GUIANA: Along the Rio Negro, 1840, *Schomburgk* 947 (N).

BRAZIL: Along the Rio Negro, between Barra and Barcellos, 1851, *Spruce* "1834 & 1947" (type collection ?; G).

This species is distinguished from its only close relative, *R. racemosa*, by its long-attenuate leaves, which are distinctly paler beneath, and its longer petals, as well as by the different number of ovules. The difference in venation indicated by Eichler does not seem to be of much consequence. Eichler describes the anthers as similar to those of *R. racemosa*, except that their appendages

are perhaps a little shorter, but I have found no trace of appendages on the anthers in any of several flowers dissected.

According to Eichler the uncertain genus *Exotanthera* Turcz.* (type and only species *E. racemosa*) may have been based on this species. The name, preoccupied in *Rinorea*, is unavailable in any case for this species.

12. *Rinorea lindeniana* (Tulasne) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

Alsodeia lindeniana Tulasne, Ann. Sci. Nat. III. Bot. 7: 364. 1847.

Alsodeia guianensis lindeniana Eichl. in Mart. Fl. Bras. 13¹: 387. 1871.

Branchlets glabrate; leaves opposite; petioles 3 to 10 mm. long; blades lanceolate, 12 to 16 cm. long, 4.5 to 5.5 cm. wide, narrowly long-acuminate, remotely undulate-crenulate, glabrous; panicles racemiform, 8 to 12 cm. long, the axis glabrous, the lower cymules 2 or 3-flowered, the pedicels subglabrous; sepals ovate, about 1.5 mm. long, obtuse, ciliolate, striatulate; petals ovate-lanceolate, 3 mm. long, glabrous, with obtuse deflexed apex; filaments thick, their glands adnate to middle, free above, shorter than the filaments, the anthers ovate, acute, unappendaged, the connective scales oblong, obtuse, longer than the anthers; ovary hispidulous, the style sigmoid at base, the placentae 1-ovulate.

TYPE LOCALITY: "Truxillo, Mérida," Venezuela, altitude 3,000 meters. Type collected by Linden (no. 247 of 1842).

Not seen; description condensed from the original. This species is evidently close to *R. riana*, but to be distinguished by the glabrous axis of its panicle, its narrowly long-acuminate lanceolate leaves, and its different staminal glands. It was referred to *Alsodeia guianensis* (= *Rinorea passoura*) by Eichler, but this was certainly incorrect. Eichler gives the type locality as near Carabobo. Triana and Planchon⁷ record the species from the basin of the Río Meta, between Villavicencio and Jiramena, altitude 250 meters, Colombia.

13. *Rinorea riana* (DC.) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

PLATE 32.

Riana guianensis Aubl. Pl. Guian. 1: 237. pl. 94. 1775. Not *Rinorea guianensis* Aubl. 1775.

Conohoria? riana DC. Prodr. 1: 312. 1824.

Alsodea prunifolia Spreng. Syst. Veg. 1: 807. 1825.

Shrub 1 to 2.5 meters high; branches sparsely hispidulous, glabrate; leaves opposite; petioles puberulous, 3 to 5 mm. long; blades elliptic-oblong to oval-oblong, 8 to 20 cm. long, 4 to 8.5 cm. wide, short-acuminate with obtuse apex, cuneate or rounded-cuneate to the sometimes obscurely cordate base, crenate-serrate, chartaceous, above deep green, beneath brownish green, glabrous or sparsely puberulous beneath along costa, the lateral veins 8 to 10 pairs, with the secondaries prominulous on both sides; flowers in a narrow racemiform puberulous panicle or rarely simple racemose, the lower branches usually 2 or 3-flowered, the upper or rarely all 1-flowered, the peduncle 3 to 10 mm. long, the axis 3.8 to 9 cm. long, rather loosely flowered; pedicels spreading or somewhat deflexed, 1 to (in fruit) 4 mm. long; sepals oval or broadly ovate, 1.2 to 1.5 mm. long, obtuse, ciliolate and somewhat appressed-puberulous, about 4-ribbed; petals pale yellow or white, oval, 2.5 to 3 mm. long, rounded at apex and scarcely reflexed, glabrous or ciliolate below; stamens free, 1.7 to 2.1 mm. long, the thick filaments 0.4 to 0.5 mm. long, adnate throughout to the glands, these free at apex, linear, usually tridenticulate, the free portion about 0.7 mm. long; anthers ovate, emarginate, not appen-

* Bull. Soc. Nat. Moscou 27²: 342. 1854.

⁷ Ann. Sci. Nat. IV. Bot. 17: 126. 1862.

daged, 0.8 to 1.3 mm. long; connective scales oval, obtuse, finely erose, glabrous, 1.3 to 1.7 mm. long; ovary densely hispid; style strongly bent at base, then straight; placentae 1-ovulate; capsule sparsely hispidulous, 15 to 18 mm. long; placentae glabrous, each with a single seed; seeds subglobose, mottled, about 7 mm. long, rather densely rufidulous-puberulent.

ILLUSTRATION: Aubl. Pl. Guian. pl. 94.

TYPE LOCALITY: Forests of Aroua, French Guiana. Type, collected by Aublet, in the British Museum.

SPECIMENS EXAMINED:

COLOMBIA: Tierra Alta, on Río Sinu, Department of Bolívar, altitude 100 to 200 meters, March, 1918, *Pennell* 4634 (G, Y). Río Sinu, 1918, *Pennell* 4776 (Y). Low forest, Sahagún, Department of Bolívar, altitude 150 to 200 meters, 1918, *Pennell* 4079 (Y).

VENEZUELA: Hacienda Puerto La Cruz, Coastal Range, Federal District, 1918, *Pittier* 8056 (N). Around Palmasola, in forest along the Aroa River, State of Lara, near sea level, June, 1913, *Pittier* 6378 (N). Guaremales, February, 1919, *Pittier* 8402 (N); in June, 1920, *Pittier* 8908 (N). Forested hills of Guaremales, altitude 350 meters, July, 1920, *Pittier* 8915 (N). Alto de Macanilla, Miranda, altitude 700 meters, June, 1923, *Jahn* 1284 (N).

TRINIDAD: Maracas, 1900, *Dannouse* 6421 (Y). Carapichaima, 1903, *Dannouse* (Y). Arima, 1904, *McLean* (Y).

FRENCH GUIANA: Aroua, *Aublet* (sketch of type; N).

This species may be distinguished by its small flowers, erose connective scales, apically unappendaged anthers, and very short filaments with the glands apical. The bent style is apparently peculiar to this and *R. lindeni-ana*. *Pennell* gives the vernacular name as "jazmin," *Jahn* as "tabaquito," and *Pittier* as "rabo de cachicamo." At first I considered all the material above cited to represent a new species, and labeled it with a manuscript name, but information as to *Aublet's* type communicated by Mr. E. G. Baker makes it fairly certain that the species described is the hitherto misunderstood *Riana guianensis* of *Aublet*.

Eichler's *Alsodeia guianensis* var. *parviflora*,⁸ based on *Kappler* 2111, from Surinam, may be referable to this species, but the description is insufficient.

EXPLANATION OF PLATE 32.—*Rinorea riana*, from *Pittier* 8908. Natural size.

14. *Rinorea micrantha* Ule, Verh. Bot. Ver. Brand. 47: 157. 1905.

Shrub or tree, 3 to 15 meters high, the branchlets sparsely pilosulous; leaves opposite; petioles 3 to 6 mm. long; blades oblong, 13 to 15 cm. long, 5 to 7 cm. wide, long-acuminate, usually slightly cordate at the oblique base, crenulate or serrulate, glabrous; panicles racemiform, 9 cm. long, pilosulous, the lower branchlets about 4-flowered; sepals elliptic, 1 mm. long, ciliolate; petals ovate-elliptic, 2 mm. long, ciliolate; stamens 1.5 mm. long, the filaments bearing a subulate gland at base, the connective scales ovate, erose, nearly twice as long as the anthers; ovary densely pilose, the placentae 1-ovulate.

TYPE LOCALITY: Upper Río Juruá, at Bocca do Tejo, Province Amazonas, Brazil. Type collected by Ule (no. 5477).

Not seen; description compiled from the original. Ule apparently considered the presence of staminal glands a new feature in the genus, but they are obvious in nearly every American species.

15. *Rinorea hýmenosepala* Blake, sp. nov.

PLATE 33.

Shrub; branchlets sordidly incurved-puberulous, glabrescent; leaves opposite or alternate; petioles incurved-puberulous, 2 to 6 mm. long; blades some-

⁸ Fl. Bras. 13¹: 387. 1871.

what rhombic-obovate or oval-obovate, 7 to 14.5 cm. long, 2.5 to 6 cm. wide, acuminate or short-pointed, narrowed to the rounded or subcordate often oblique base, coarsely crenate-serrate with acutely mucronulate teeth, chartaceous, puberulous on costa above or glabrate, beneath lighter green, hispidulous along costa and sometimes along the 8 to 13 pairs of lateral veins, loosely reticulate; panicle terminal, 4.5 cm. long, sordid-puberulous with ascending hairs, the peduncle 2.2 cm. long, equaling the axis of inflorescence, the few branches 3-flowered, the pedicels about 2.5 mm. long; sepals ovate or lance-ovate, 2.5 to 3 mm. long, acuminate, hyaline, weakly 3-veined, ciliate, on back sparsely pilose; petals white, oblong, 5.2 mm. long, rounded at apex, glabrous except for the tufted apex; stamens 3.7 mm. long, the filaments 0.4 to 0.5 mm. long, rather broad, slightly exceeded by the small adnate gland, the anthers oblong-ovate, 1.7 mm. long, bearing at apex 1 or 2 linear to oblanceolate membranaceous upwardly serrate appendages about 0.8 mm. long, the connective scales oblong, 3.2 mm. long, broadly rounded at apex, strongly erose especially below, glabrous; ovary densely hispid-pilose, the placentae 1-ovulate.

Type in the herbarium of the New York Botanical Garden, collected in forests at Malena, Department of Antioquia, Colombia, altitude 150 to 170 meters, January 12, 1918, by F. W. Pennell (no. 3783). Photograph in the U. S. National Herbarium.

This species is distinguished from *R. ulmifolia*, apparently its closest ally, by its oblong, strongly erose scales and appendaged anthers. It is of special interest as the only species seen in which opposite and alternate leaves occur on the same branch. In this case all the leaves on the older part of the specimen are truly alternate, while those on the younger shoots are opposite. It is noteworthy also for the size of the anther appendages.

EXPLANATION OF PLATE 33.—*Rinorea hymenosepala*, from the type specimen. Natural size.

16. *Rinorea ulmifolia* (H. B. K.) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

Conoria ulmifolia H. B. K. Nov. Gen. & Sp. 5: 387. pl. 491. 1825.

Alsodea ulmifolia Spreng. Syst. Veg. 1: 807. 1825.

Shrub with glabrous branches; leaves opposite; petioles 2 to 4 mm. long, puberulous; blades obovate or elliptic-obovate, 7.5 to 11 cm. long, 2.5 to 4 cm. wide, acuminate or short-pointed, at base usually subcordate, serrate, the younger pilose on both sides, the older puberulous on the venation; panicles about 3 cm. long, pubescent, the branchlets 1 or 2-flowered; sepals elliptic, ciliolate; petals ovate, 4 or 5 mm. long, obtusish, glabrous, about twice as long as the sepals; filaments very short, unappendaged, the anthers unappendaged, the connective scales about twice as long, oblong-obovate (in figure), rounded, entire, glabrous; ovary pilose, the placentae 1-ovulate; capsule 3-seeded, about 9 mm. long, pilosulous above; seeds glabrous.

TYPE LOCALITY: Near La Boca de San Bartolomé, shore of the Río Magdalena, Colombia. Type collected by Humboldt and Bonpland.

Not seen; description condensed from the original. To be distinguished by its entire connective scales, eglandular filaments, and leaves puberulous on the veins. Triana and Planchon* record the species from Santa Ana, on the Río Magdalena, altitude 1,168 meters (*Linden* 1168), and from Agua Chica, Province of Ocaña, altitude 165 meters (*Schlim* 272).

17. *Rinorea hummeli* Sprague, Kew Bull. 1921: 307. 1921.

Medium-sized tree; young branchlets minutely spreading-pubescent; leaves opposite; petioles 3 to 5 mm. long, minutely pubescent; blades obovate,

* Ann. Sci. Nat. IV. Bot. 17: 126. 1862.

6 to 13 cm. long, 2.5 to 6.5 cm. wide, acutely acuminate (the point 6 to 12 mm. long), subcuneate at base, obscurely denticulate, chartaceous, above glabrous except for the minutely furfuraceous-pubescent costa, beneath glabrous, shining, the veins (7 or 8 pairs) and reticulate veinlets prominulous on both sides; panicles racemiform, terminal and axillary, 1.5 to 3 cm. long, shortly spreading-pubescent, the lower branches with 5 flowers or fewer, the pedicels 2 mm. long, the bracts 1 mm. long, pubescent and ciliolate; sepals broadly ovate, 1 to 1.2 mm. long and wide, short-cuspidate or apiculate, ciliolate; petals lanceolate, 4.5 mm. long, 1.7 to 2 mm. wide, obtuse, revolute above; filaments 0.5 mm. long, 0.6 mm. wide, the connective scales narrowly lanceolate, 3 mm. long, 1 to 1.1 mm. wide, the anthers ovate, 1.5 mm. long, minutely biapiculate; ovary fulvous-velutinous, the placentae 2-ovulate, the style pubescent in its lower third, 3 mm. long.

TYPE LOCALITY: Salt Creek, British Honduras. Type collected by Hummel.

Description compiled from the original. The local name is given as "wild coffee." The collector states that the young plants are often mistaken for mahogany seedlings.

18. *Rinorea sylvatica* (Seem.) Kuntze, Rev. Gen. Pl. 1:42. 1891, as *R. sylvatica*.

Alsodeia sylvatica Seem. Bot. Voy. Herald 79. pl. 14. 1852.

Shrub or small tree; branchlets puberulent and hispid-pilose, glabrate; leaves opposite; petioles 3 to 6 mm. long, similarly pubescent; blades oval-obovate or obovate, 6 to 12 cm. long, 2.8 to 5.5 cm. wide, short-acuminate, narrowed to an oblique subcordate base, crenate-serrulate or subentire, papery, puberulous on costa above, beneath on the veins and toward margin puberulous and hispid-pilose or strigose; racemes about 4 cm. long, rather dense, densely hispid-pilose with rufescent erect or appressed hairs, the pedicels 2 mm. long or usually less, exceeded by the bracts and bractlets; sepals ovate, 3 to 4.5 mm. long, acute, dry, indurated, scarious-margined, strongly many-nerved, hispid with erect rufescent hairs; petals oblong, yellowish white, 5 mm. long, obscurely short-pointed but obtuse, spreading at apex, rufescent-hispid along midline with erect hairs; stamens 3.5 mm. long, the filaments 0.8 mm. long, not bearing a gland, the anthers 1.5 mm. long, sometimes 1-mucronate at apex, the connective scales elliptic-ovate, narrowed to an obtuse apex, entire or obscurely erose below, appressed-rufescent-hispid on back above middle; ovary densely rufescent-hispid, the placentae 3-ovulate; capsule oblong-ellipsoid, 2.2 cm. long, spreading-puberulous; seeds about 3 to each placenta, subglobose, 4.5 mm. thick, densely spreading-puberulous with sordid hairs.

TYPE LOCALITY: Near Cruces, Panama. Type collected by Seemann.

SPECIMENS EXAMINED:

PANAMA: Along Caño Quebrado, Canal Zone, June, 1914, *Pittier* 6665 (N).

COLOMBIA: Forest, Boca Verde, on Rio Sinú, Department of Bolívar, altitude 100 to 300 meters, 1918, *Pennell* 4212 (G, Y), 4569 (Y).

Distinct in its dry, indurate, strongly striate, hispid sepals only slightly shorter than the petals, and short pedicels exceeded by the bracts and bractlets.

19. *Rinorea martini* (Turcz.) Blake.

Alsodeja martini Turcz. Bull. Soc. Nat. Moscou 36¹: 557. 1863.

Leaves opposite; petioles very short; blades rhombic-ovate, long-pointed, narrowed at base, serrulate, glabrous; racemes axillary, half as long as the leaves, densely pubescent; sepals striate, puberulous; petals once and a half as long as the sepals, narrowed to an obtuse point; filaments very short, free, bearing a gland at apex; anthers multisetose.

TYPE LOCALITY: Cayenne. Type collected by Martin.

Not seen; description translated from the original. The plant described and figured by Oudemans¹⁰ as *Alsodeia flavescens*, from material collected by Martin in French Guiana, is probably the same. The petals are said to be little longer than the sepals, but the stamens are figured as with filaments nearly as long as the anthers. In this respect his plant resembles *Rinorea passoura*, but that has petals more than twice as long as the sepals.

20. *Rinorea flavescens* (Aubl.) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

Conohoria flavescens Aubl. Pl. Guian. 1: 239. pl. 95. 1775.

Alsodea flavescens Spreng. Syst. Veg. 1: 806. 1825.

Shrub; branchlets puberulous and hispid-pilose, glabrate; leaves opposite; petioles 3 to 7 mm. long, pubescent like the branchlets; blades obovate to oval, 7 to 20 cm. long, 2.2 to 8 cm. wide, short-acuminate, at base cuneate to rounded, obsoletely crenate-serrulate or subentire, papery, above puberulous along costa or glabrous, beneath sparsely hispid or strigose on costa or glabrous; racemes about 7 cm. long, finely spreading-puberulous; pedicels 2 to 4 mm. long; sepals oval or ovate, 1.5 to 2.3 mm. long, rounded or obtuse, ciliolate, weakly several-nerved; petals oblong-lanceolate to elliptic-ovate, yellow, 4.2 to 4.5 mm. long, obtusish, with recurved very sparsely hispidulous apex, otherwise glabrous; stamens 2.7 to 3 mm. long, the filaments 0.7 mm. long, equaling or exceeding the deltoid tridenticulate gland, this adnate for half its length or more, the anthers 1 mm. long, not appendaged, the connective scales 2.3 mm. long, oblong-ovate, obtuse, entire or obscurely erose below, glabrous; ovary glabrous, sometimes with a few hairs, the placentae 1 or 2-ovulate; capsule 2 to 2.5 cm. long, usually 2-seeded; seeds glabrous.

ILLUSTRATION: Aubl. Pl. Guian. pl. 95.

TYPE LOCALITY: Near the River Sinémari, French Guiana, forty leagues from the coast. Type, collected by Aublet, in the British Museum.

SPECIMENS EXAMINED:

BRITISH GUIANA: Without definite locality, *Schomburgk* 119 in part (N), 336 in part (N).

FRENCH GUIANA: Near the River Sinémari, *Aublet* (sketch of type, N).

BRAZIL: Without definite locality, *Burchell* 9727 (G, Y).

Readily distinguished among the species with opposite leaves and simply racemose flowers by its glabrous ovary. As already noted by Eichler in the case of no. 336, both nos. 119 and 336 of Schomburgk are mixtures, the other species in each case being *R. passoura*.

Aublet gives the native name as "conohorié," and Eichler, on the basis of a drawing from Pará, gives the name "jacamim-renepea" for this species.

I have followed Eichler in the interpretation of Aublet's species. Aublet describes and figures the sepals and petals as acute or acuminate, which is not the case in any specimens I have examined. Eichler lists the species from Pará, the three Guianas, and eastern Peru. Mr. Baker writes me that the type bears a few hairs on the ovary, an occasional feature already mentioned by Eichler in describing the species. I have found it perfectly glabrous in the material examined.

21. *Rinorea passoura* (DC.) Kuntze, Rev. Gen. Pl. 1: 42. 1891, as *R. passura*.

Passoura guianensis Aubl. Pl. Guian. 2: Suppl. 21. pl. 380. 1775. Not *R. guianensis* Aubl. 1775.

¹⁰ Arch. Néerl. 2: 194. pl. 4. 1867.

Conohoria passoura DC. Prodr. 1: 312. 1824, in part.

Alsodeia pubiflora Benth. Journ. Bot. Hook. 4: 106. 1842.

Alsodeia guianensis Eichl. in Mart. Fl. Bras. 13¹: 387. 1871.

Rinorea panura Dur. & Jacks. Ind. Kew. Suppl. 1: 365. 1906, as synonym.

Shrub or small tree; branches puberulous and hispid-pilose; leaves opposite; petioles 5 to 10 mm. long; blades oval to elliptic, 8 to 17.5 cm. long, 3 to 8 cm. wide, short-pointed to acuminate, at base rounded to cuneate, obscurely crenate-serrulate or subentire, puberulous on costa above, sparsely hispid-pilose on costa and sometimes on veins beneath; racemes 3.5 "to 10" cm. long, densely ferrugineous-puberulous, the pedicels about 4 mm. long; sepals broadly ovate or orbicular-ovate, 1.8 to 2 mm. long, obtusish, strongly several-ribbed, cillolate, on back rather densely pilosulous and more or less puberulous; petals oval-oblong, "white or yellow," 4.2 to 5.5 mm. long, obtuse, scarcely narrowed toward apex, very shortly reflexed, pilose along midline with erect rufidulous hairs, cillolate near apex; stamens 3.1 to 3.8 mm. long, the filaments 0.8 to 1 mm. long, equaling or exceeding the oblong gland which is free above the middle, the anthers 1.3 to 1.5 mm. long, 1 or 2-cuspidate or 2 to 4-setose at apex, the connective scales oblong-ovate, 2.3 to 2.6 mm. long, obtuse, obscurely erose; ovary densely hispid-pilose, the placentae 2 or 3-ovulate; "capsule 2 to 3 cm. long, tomentose, glabrate; seeds 3 to each placenta, velvety-tomentose."

ILLUSTRATIONS: Aubl. Pl. Guian. pl. 380; Mart. Fl. Bras. 13¹: pl. 78, f. 2 (fruit, seed).

TYPE LOCALITY: Forests of Timoutou, French Guiana. Type collected by Aublet.

SPECIMENS EXAMINED:

COLOMBIA: Between Villavicencio and San Martín, basin of the Río Meta, altitude 250 meters, *Triana* (Y).

BRITISH GUIANA: Banks of rivers, *Schomburgk* 573 (type of *A. pubiflora*; a single flower examined, N). Without definite locality, 1837, *Schomburgk* 119 in part (N), 336 in part (N, Y).

This species was originally described by Aublet from fruiting material. De Candolle united *Conohoria flavescens* Aubl. and *Passoura guianensis* under the name *Conohoria passoura*, indicating by a sign of affirmation that he had seen authentic material of the former but not of the latter name. I have followed Eichler in his interpretation of the species, but not in all his reductions. *Alsodeia pubiflora*, known to me only by a single flower from the type forwarded by Dr. Otto Stapf, I was at first inclined to consider a distinct species, having found the anther cells about 4-setose with filiform setae at apex, while in Eichler's *A. guianensis* (*R. passoura*) they were described as like those of *A. falcata*, that is, 1 or 2-cuspidate. In a single flower of Schomburgk's no. 336, however, I found anthers with 2 or 3 filiform setae or with a single linear-lanceolate cusp passing at apex into three filiform setae, showing that Eichler's reduction of this species is correct. On the other hand, *A. Lindeniana* Tulasne, considered a variety by Eichler, is certainly a very distinct species, having unappendaged anthers, racemo-paniculate flowers, small petals, and solitary ovules. *Alsodeia brevipes* and *A. laxiflora*, treated as independent varieties by Eichler, I consider inseparable from one another but specifically distinct from the *Alsodeia guianensis* described by Eichler. Eichler's var. *parviflora* is unknown to me. *Alsodeia flavescens*, as described and figured by Oudemans¹¹ (but not *Conohoria flavescens* of Aublet), is also referred by Eichler to his *A. guianensis*, but from the description of the petals as little exceeding the sepals

¹¹Arch. Néerl. 2: 194. pl. 4. 1867.

it is probably rather *Rinorea martini* (above, no. 19). Eichler records the typical form of *R. passoura* from Pará, the three Guianas, and Maynas, Peru.

A sheet in the herbarium of the New York Botanical Garden, belonging to a collection originally recorded and described by Triana and Planchon¹² as *Alsodeia flavescens*, shows a peculiar abnormality in the stamens. The filaments are 1 mm. long, about twice as long as the pubescent basal glands; the connective scales narrowly lanceolate, 3 mm. long, entire, sparsely strigose dorsally; the anthers, described by Triana and Planchon as about equaling the scale, are in this specimen almost entirely aborted; the ovary is densely hispid-pilose, with the placentae 2-ovulate. Triana and Planchon questioned whether this collection might be abnormal or might indicate polygamy or diecliny in the flowers of *Alsodeia*. As this is the only specimen of *Rinorea* out of several score I have examined which shows such stamens, it is clear that the peculiarity is a purely individual and abnormal one.

22. *Rinorea guatemalensis* (S. Wats.) Bartlett, Proc. Amer. Acad. 43: 56. 1907.

Alsodeia guatemalensis S. Wats. Proc. Amer. Acad. 21: 458. 1886.

Branchlets densely spreading-puberulous, glabrate; leaves opposite; petioles puberulous, 4 to 9 mm. long; blades oval or obovate-oval to elliptic-oblong, 7 to 14.5 cm. long, 2.5 to 6 cm. wide, short-pointed or acuminate with obtuse apex, at base cuneate, pergamentaceous, subentire, obscurely puberulous along costa and sometimes along veins above, sparsely strigose or hispidulous along costa and sometimes along veins beneath, loosely prominulous-reticulate; racemes 3 to 6.5 cm. long, densely rufescent-puberulous with spreading hairs, the pedicels 2 to 4 mm. long; sepals ovate to deltoid-ovate, 1 to 1.5 mm. long, acute or acutish, rarely obtuse, not striate, ciliolate, usually puberulous along midline; petals lance-ovate, 5.5 mm. long, narrowed to an obtusish reflexed apex, ciliolate below and very sparsely so at tip, rarely with three or four hairs on back; stamens 4 to 4.5 mm. long, the filaments slender, 0.8 mm. long, about equaled by the sometimes puberulous gland, the anthers 1.6 mm. long, bearing 1 or 2 cusps or unappendaged, the connective scales lance-ovate, 3.2 to 3.7 mm. long, narrowed to an obtuse apex, strongly erose or crisped below; ovary densely hispid-pilose, the placentae 1-ovulate; capsule 13 to 19 mm. long, spreading-puberulous, the placentae and young seeds glabrous; mature seeds subglobose, 6 mm. thick, fuscous-brown, rather sparsely puberulous.

TYPE LOCALITY: Banks of the Río Chocón, Guatemala.

SPECIMENS EXAMINED:

OAXACA: Teotalcingo to Choapan, altitude 1,800 meters, 1919, *Reko* 4082

(N). Near Santo Domingo, altitude 270 meters, 1895, *Nelson* 2661 (N).

GUATEMALA: Banks of the Río Chocón, Department of Izabal, March 4 and 25, 1885, *Watson* 15 (type; G, photograph N). Finca Sepacuité, Department of Alta Verapaz, 1902, *Cook & Griggs* 744 (N).

HONDURAS: Tree on mountain creek among rocks, San Pedro Sula, Department of Santa Bárbara, altitude 400 meters, April, 1890, *Thieme* 820 (J. D. Smith, no. 5339; G, N, Y). Puerto Sierra, 1903, *Wilson* 295 (Y), 675 (Y).

This is the only species with opposite leaves, simple racemes, and appendaged anther sacs known north of the Isthmus of Panama. Its closest relative is undoubtedly *R. pilosula* (no. 37), of Tabasco, which has entire connective scales and always unappendaged anthers.

¹²Ann. Sci. Nat. IV. Bot. 17: 127. 1862.

- 23. *Rinorea marginata*** (Triana & Planch.) Rusby; J. R. Johnston, Proc. Bost. Soc. Nat. Hist. **34**: 238. 1909.

Alsodecia marginata Triana & Planch. Ann. Sci. Nat. IV. Bot. **17**: 127. 1862.

Tree; branchlets densely spreading-puberulous, glabrate; leaves opposite; petioles densely puberulous, 3 to 5 mm. long; blades oval to oblong-elliptic, 6 to 11 cm. long, 2.4 to 4.3 cm. wide, short-acuminate, at base equal and cuneate, with thickened strictly entire margin, coriaceous, prominulous-reticulate especially beneath, above light green, glabrous or densely spreading-puberulous along costa, beneath sparsely strigose along costa or densely and softly rufidulous-puberulous with spreading hairs over whole surface, then also ciliolate on margin; racemes (immature) puberulous, about 2 cm. long, the pedicels short; sepals deltoid-ovate to suborbicular-ovate, 1.5 to 2 mm. long, acutish to obtuse, apiculate, strongly striate-veined, ciliolate, otherwise glabrous; petals (scarcely mature) ovate, 4.7 mm. long, obtuse, ciliolate below middle and at apex, erect; stamens 3.8 mm. long, the filaments broad, 0.5 mm. long, adnate throughout to the glands, these rounded and free for 0.3 mm. at apex of filament, the anthers oblong, 1.8 mm. long, 2-aristate, the connective scales oblong-ovate, 3.3 mm. long, obtuse, glabrous, obscurely erose below; ovary densely hispid, the placentae 4-ovulate; "capsule trigonous-oblong, 3.5 cm. long, veiny; seeds 2 to each placenta," globose, 7 mm. in diameter, mottled, densely rufid-puberulous.

TYPE LOCALITY: Pass of Opia, along the Río Magdalena, Colombia.

SPECIMENS EXAMINED:

COLOMBIA: Pass of Opia, along the Río Magdalena, Provinces of Bogotá and Mariquita, altitude 600 meters, *Triana* (type collection; Y, photograph and fragment N).

This species is very distinct in its thick, entire, marginate leaves. The sheet examined bears two branches and a pocket containing a single seed. The branches are remarkably dissimilar. One, a small piece bearing four leaves and a short raceme with the flowers in bud only, has the leaves strictly glabrous except for a few appressed hairs on the costa beneath. In the other, an ample branch bearing a couple of still younger racemes, the leaves are puberulous on the costa above, and densely and softly rufid-puberulous beneath, with the margins ciliolate. Triana's description was drawn up to cover both. In view of the entire agreement of the leaves in all other features than pubescence, I can only consider them as two extremes of a single species, which in this respect shows a variation unequaled by any other American member of the genus. Field observations on the species are greatly to be desired.

This species has been confused in herbaria with *R. melanodonta*. As originally published, the combination *Rinorea marginata* referred entirely to the latter species, which is at once distinguished by its sharply serrulate leaves, as well as by its shorter filaments, somewhat different glands, fewer ovules, and smaller capsule.

- 24. *Rinorea brachythrix*** Blake, sp. nov.

PLATE 34.

Shrub; branches in age sparsely hirtellous or glabrate; leaves opposite; petioles hirtellous, 8 to 14 mm. long; blades oblong-elliptic, 11.5 to 16 cm. long, 3.8 to 5.3 cm. wide, acuminate, at base cuneate or cuneate-rounded, repand-serrulate with acute black gland-tipped teeth, coriaceous and strongly prominulous-reticulate, sparsely hirtellous on costa above, sparsely strigose on costa beneath; racemes terminal, 2 to 4 cm. long, fulvescent-puberulous with spreading hairs, the pedicels 2 to 4 mm. long; sepals ovate, 2 to 2.5 mm. long, acute, firm, scarcely striate, ciliolate, strigillose chiefly above; petals yellow,

oblong-ovate, 5 mm. long, obtuse, reflexed at apex, sparsely ciliolate below, otherwise glabrous; stamens 3.8 to 4 mm. long, the filaments 0.4 mm. long, about equaled by the small adnate gland, the anthers elliptic-oblong, 2.2 mm. long, 2-mucronate, the connective scales 3.5 mm. long, oblong-ovate, obtuse, glabrous, obscurely erose; ovary densely hispidulous, the placentae 2-ovulate; immature capsule apiculate, 15 mm. long, densely hispidulous, the inner surface, placentae, and seeds (2 to each placenta) sparsely puberulous.

Type in the U. S. National Herbarium, no. 716664, collected on hills, vicinity of La Palma, southern Darién, Panama, altitude 50 meters or less, April 26, 1914, by H. Pittier (no. 6601).

Related to *R. melanodonta*, but distinguished by the very short filaments and comparatively long anther sacs.

EXPLANATION OF PLATE 34.—*Rinorea brachythrix*, from the type specimen. Natural size.

25. *Rinorea melanodonta* Blake, sp. nov.

PLATE 35.

Tree 4 to 5 meters high; branchlets sparsely or rather densely puberulous and hispid-pilose, glabrate; leaves opposite; petioles more or less puberulous and hispid-pilose, 3 to 8 mm. long; blades lance-elliptic, sometimes elliptic-oval, 7 to 16 cm. long, 2.5 to 5.5 cm. wide, gradually acuminate, at base acutely cuneate or acuminate, serrulate with small but usually conspicuous black glandular teeth, coriaceous, thickened on margin, strongly prominulous-reticulate on both sides, above puberulous on costa or glabrous, beneath sparsely rufid-strigose on costa; racemes terminal, 3 to 5 cm. long, loosely flowered, densely rufid-puberulous with spreading or ascending hairs and sometimes sparsely hispid-pilose, the lowest pedicels rarely 2-flowered; pedicels 3 to 7 mm. long; sepals deltoid or deltoid-ovate, 2 to 3.2 mm. long, acute to obtuse, ciliolate, sometimes sparsely pubescent on back, strongly about 5-ribbed at least in age; petals oblong-ovate, 5.5 to 5.8 mm. long, obtuse, ciliolate below and toward apex, sometimes tufted at the reflexed apex; stamens 4.5 mm. long, the filaments 1 mm. long, equaled by the fleshy oblong sometimes ciliate glands which are free above the middle, the anthers oblong-ovate, 1.8 to 2 mm. long, 2-cuspidate, the connective scales oblong-ovate, obtuse, obscurely erose, 3.5 mm. long; ovary densely hispid-pilose, rarely densely hispidulous, the placentae 2-ovulate; capsule 2.4 to 2.7 cm. long, apiculate, finely hispidulous; seeds 2 to each valve, densely rufidulous-pilosulous.

Type in the U. S. National Herbarium, no. 533722, collected on bank of stream in forest near Masinga Vleja, near Santa Marta, Colombia, altitude 245 meters, February 3, 1898-99, by Herbert H. Smith (no. 1756). Duplicates in the Gray Herbarium and the herbarium of the New York Botanical Garden.

ADDITIONAL SPECIMENS EXAMINED:

COLOMBIA: Local in damp forest near Masinga, vicinity of Santa Marta, altitude 150 to 760 meters, *Herbert H. Smith* 900 (G, N, Y).

VENEZUELA: El Valle, Margarita Island, 1901, *Miller & Johnston* 225 (G).
San Juan Mountain, Margarita Island, altitude 300 meters, 1903, *Johnston* 120 (G, N).

A species well characterized by its usually lance-elliptic, strongly coriaceous and reticulate, rather sharply serrulate leaves, usually gradually acuminate at both ends. Specimens in herbaria have been distributed as *Alsodeia guianensis* and *Rinorea marginata*.

EXPLANATION OF PLATE 35.—*Rinorea melanodonta*, from the type specimen. Natural size.

26. *Rinorea falcata* (Mart.) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

Alsodeia falcata Mart.; Eichl. in Mart. Fl. Bras. 13¹: 386. 1871.

Branchlets puberulous, quickly glabrate; leaves opposite; petioles 4 to 6 mm. long; blades elliptic to oblong-oval, 9.5 to 13 cm. long, 3 to 5 cm. wide, falcate-

acuminate, at base acutely cuneate, remotely and obscurely serrulate, papery, glabrous on both sides or obscurely strigillose on costa beneath; racemes about 8 cm. long, sordid-puberulous, the pedicels deflexed, 3 mm. long; sepals oval or oval-ovate, rounded, 1.6 to 2.3 mm. long, ciliolate, along midline somewhat puberulous or subglabrous; petals "yellow," elliptic-ovate, 4 mm. long, obtuse, reflexed at apex, glabrous; stamens 3.2 mm. long, the filaments 0.7 mm. long, usually much longer than the basal gland or rarely equaled by it, the anthers 1.2 mm. long, 2-cuspidate, the connective scales ovate, 2.5 mm. long, obtuse, somewhat erose below; ovary densely pilose, the placentae 2-ovulate; "capsule 2 cm. long, glabrate; seeds 2 to each valve, glabrous."

TYPE LOCALITY: Forests along the Rio Yapurá, Province of Alto Amazonas, Brazil. Type collected by Martius.

SPECIMEN EXAMINED:

BRAZIL: Upper Amazon and tributaries, *Traill* (G).

Eichler records this species from along the Rio Negro between Barcellos and Santa Isabel, and from near Manáos, as well as from the type locality. He describes also a variety *grandifolia*, with leaves 15 to 20 cm. long, 6 to 10 cm. wide, from woods near Ega, where it was collected by Martius. My description is drawn from the excellent specimen in the Gray Herbarium collected by Traill.

27. *Rinorea brevipes* (Benth.) Blake.

Alsodeia brevipes Benth. Journ. Bot. Hook. 4: 106. 1842.

Alsodeia laxiflora Benth. Journ. Bot. Hook. 4: 107. 1842.

Conohoria brevipes Miquel, Linnaea 22: 556. 1849.

Conohoria laxiflora Miquel, Linnaea 22: 556. 1849.

Alsodeia guianensis brevipes Eichl. in Mart. Fl. Bras. 13¹: 387. 1871.

Alsodeia guianensis laxiflora Eichl. in Mart. Fl. Bras. 13¹: 387. 1871.

Branchlets puberulous and hispid, glabrate; leaves opposite; petioles densely puberulous and somewhat hispid, 4 mm. long; blades elliptic or elliptic-oval, 5 to 8 cm. long, 2 to 2.8 cm. wide, obtusely short-pointed, at base cuneate or rounded-cuneate, pergamentaceous, crenate-serrulate, puberulous on costa above, beneath strigose on costa and often on veins, sometimes also on surface, sometimes barbate in the axils of the veins; racemes about 4 cm. long or less, densely sordid-puberulous; pedicels 3 mm. long, or obsolescent; sepals oval or oval-ovate, 2.4 to 2.7 mm. long, acutish to obtusish, ciliolate, on back sparsely or usually densely puberulous, strongly striate; petals elliptic or lance-elliptic, 4.5 to 6 mm. long, obtuse, shortly reflexed, glabrous except for the ciliolate-tufted apex; stamens 3.8 to 4 mm. long, the filaments 0.6 to 0.8 mm. long, about twice as long as the sometimes pubescent apically free glands, the anthers 1.3 to 1.6 mm. long, unappendaged or rarely bearing at apex one or two filiform setae, the connective scales 3 to 3.2 mm. long, oblong-ovate, obtuse, finely erose; ovary densely hispid, the placentae 1 or 2-ovulate.

ILLUSTRATION: Hook. Icon. Pl. 1: pl. 63 (as *Conohoria castanaefolia*).

TYPE LOCALITY: Banks of the Rio Quitaro, British Guiana.

SPECIMENS EXAMINED:

BRITISH GUIANA: Banks of the Rio Quitaro, 1838, *Schomburgk* 574 (type collection; N). Banks of the Rio Rupunoony, 1837, *Schomburgk* 125 (type collection of *A. laxiflora*; N).

Eichler considered Bentham's two species to represent two varieties of *Alsodeia guianensis* (*R. passoura*), distinguished in common from the typical form by their small leaves, and from one another chiefly by the difference in length of the pedicels. Fortunately both species are represented in the U. S. National Herbarium by specimens of the type collections, which agree precisely in all features except the inflorescence. The specimen of *A. brevipes*

has a very young inflorescence, with crowded subsessile flowers, while that of *A. laxiflora* is mature and loose. The species as here taken is distinguished from *Rinorea passoura* chiefly by its externally glabrous petals and unappendaged or merely 1 or 2-setose anther cells. Benthams gives the number of ovules as 1 or 2 on the placentae; I have found them solitary in the only ovary dissected. The figure in Hooker's *Icones* is a good illustration of the species, except that the leaves are represented as alternate. Dr. Stapf informs me, however, that they are opposite in the type in the Kew Herbarium, which is doubtless the specimen from which the figure was drawn.

28. *Rinorea deflexa* (Benth.) Blake.

Alsodeia deflexa Benth. Bot. Voy. Sulph. 67. 1844.

Branchlets and petioles hirtellous, glabrate; leaves opposite; petioles hirtellous, glabrate, 4 to 6 mm. long; blades oval-elliptic, 5 to 10 cm. long obtusely short-acuminate, rounded at base, obtusely dentate, submembranaceous; racemes simple, 5 cm. long, hirtellous; pedicels 2 mm. long, deflexed; sepals ovate, 2 mm. long, obtusish, thin, about 5-veined, ciliolate or ciliate, puberulous along midline; petals lance-ovate, 4.5 mm. long, narrowed to an obtuse apex, short-ciliate, otherwise glabrous; stamens 3.5 mm. long, the filaments 0.7 mm. long, somewhat exceeding the gland, the anthers 1.5 mm. long, shortly 1-mucronate or unappendaged, the connective scales elliptic-ovate, 2.8 mm. long, narrowed to an obtuse apex, obscurely erose below; ovary densely hispid-pilose, the placentae 1-ovulate.

TYPE LOCALITY: Atacames, Ecuador.

SPECIMEN EXAMINED:

ECUADOR: Atacames, *Barclay* (type collection; a single flower, N).

This description is compiled from the original, except for the characters of the flower, which are drawn from a single flower of the type forwarded by Dr. Otto Stapf, who states that the leaves are opposite.

29. *Rinorea ovalifolia* (Britton) Blake.

PLATE 36.

Alsodeia ovalifolia Britton, Bull. Torrey Club 16: 18. 1889.

Branchlets densely hirtellous, tardily glabrate; leaves opposite; petioles densely hirtellous, 3 to 5 mm. long; blades oval or obovate-oval, 7 to 11 cm. long, 3.5 to 6 cm. wide, acutely short-pointed, at base cuneate to rounded, serrulate, papery, hirtellous on costa and veins above, beneath hirtellous on all the veins and veinlets; racemes 5 to 10.5 cm. long, densely hirtellous, densely flowered; pedicels 2 mm. long, strongly deflexed; sepals oval to orbicular-ovate, 1.6 mm. long, obtuse or rounded, ciliolate, more or less puberulous on back, not striate; petals ovate, 3.3 mm. long, narrowed to an obtuse reflexed apex, ciliolate above or glabrous; stamens 2.7 mm. long, inserted on the inner side of a short sparsely pilose disk, the filaments 0.3 mm. long, shorter than the triangular glands, the anthers 1.1 mm. long, unappendaged, the connective scales narrowly oblong-ovate, 2.4 mm. long, narrowed to an obtuse apex, glabrous, entire or obscurely erose; ovary and base of style densely hispidulous, the placentae 2-ovulate; capsule puberulous, 12 to 18 mm. long; seeds solitary on the valves, about 4 mm. thick, glabrous.

TYPE LOCALITY: Junction of the Rivers Beni and Madre de Diós, Bolivia.

SPECIMENS EXAMINED:

BOLIVIA: Junction of the Rivers Beni and Madre de Diós, August, 1886,

Rusby 1916 (type collection; G, N, Y).

This species is well marked by its oval hirtellous leaves and dense conic-cylindric racemes of very small, strongly deflexed flowers. The original description of the leaves as glabrous is incorrect.

EXPLANATION OF PLATE 36.—*Rinorea ovalifolia*, from a specimen of the type collection. Natural size.

30. *Rinorea macrocarpa* (Mart.) Kuntze, Rev. Gen. Pl. 1: 42. 1891.

Alsodeia macrocarpa Mart.; Eichl. in Mart. Fl. Bras. 13¹: 385. pl. 78, f. 1. 1871.

Branchlets puberulous, glabrate; leaves opposite; petioles 5 to 10 mm. long; blades oval or obovate-oval, 10 to 20 cm. long, 5 to 8 cm. wide, short-pointed, acute at base, membranaceous, repand-serrate, at first puberulous, quickly glabrate; racemes spiciform, 4 to 6 cm. long, yellowish-puberulous, the flowers subsessile; sepals ovate-oblong, 1 mm. long, acute, puberulous and ciliolate; petals oblong-lanceolate, 3 mm. long, obtuse, glabrous, revolute at apex; stamens scarcely shorter than the petals, the filaments nearly as long as the anthers, apparently not gland-bearing, the anthers obtuse, the connective scales scarcely once and a half as long, oval, rounded, lacerate-erose; ovary villous, the placentae 2 or 3-ovulate; capsule acute, 4 to 5 cm. long, at length glabrate, the valves 2-seeded, the seeds glabrous.

TYPE LOCALITY: Province of Alto Amazonas, Brazil. Type collected by Martius.

Not seen; description taken from the original. In addition to the type, Eichler refers to this species material from the southern shore of the Amazon at the mouth of the Solimoes, and from Manáos, collected by Spruce (nos. 1603, 1320 *), as well as material from Borba, Pará, collected by Riedel. The species is noteworthy for its capsule, the largest known among American species of the genus, and for its subsessile flowers. The figures of the stamens indicate that they are much like those of *R. riana*, but no mention is made of the gland on the filament.

31. *Rinorea juruana* Ule, Verh. Bot. Ver. Brand. 47: 158. 1905.

Shrub or tree, 3 to 10 meters high; branchlets puberulous; leaves opposite; petioles 2 to 3 mm. long; blades obovate or oblong, 4 to 6 cm. long, 2 to 2.5 cm. wide, acuminate, obtuse at apex, minutely subspinulose-serrate, short-pubescent on the veins especially above; racemes 2 to 3 cm. long, few-flowered, puberulous, the pedicels 3 mm. long; sepals broad-elliptic, 1.5 mm. long, acutish; petals oblong-obovate, whitish yellow, 4 to 5 mm. long; stamens 3.5 mm. long, the filaments 1 mm. long, strongly thickened, the connective scales ovate, entire, 2.5 mm. long, twice as long as the anthers; ovary densely hairy; capsule trigonous, 15 mm. long, acuminate, sparsely pilose; seeds solitary on each valve, glabrous, 6 mm. thick.

TYPE LOCALITY: Miry, on the Rio Juruá, Province of Amazonas, Brazil. Type collected by Ule (no. 5633).

Not seen; description translated from the original.

32. *Rinorea viridifolia* Rusby, Mem. Torrey Club 6: 5. 1896.

Branchlets sparsely hispid-pilose, quickly glabrate; leaves opposite; petioles densely puberulous, glabrate, 4 to 10 mm. long; blades obovate or oblong-obovate, 6 to 11.5 cm. long, 2 to 4.5 cm. wide, obtusely acuminate or short-pointed, at base cuneate or rounded-cuneate, crenate-serrulate, subpergameneous, puberulous on costa above, sparsely strigose along base of costa beneath or glabrous; racemes 4.5 cm. long, sparsely and obscurely puberulous; pedicels essentially glabrous, 2.5 to 3.5 mm. long; sepals oval-ovate, 1.2 to 1.5 mm. long, obtuse or acutish, ciliolate, sparsely puberulous along midline or glabrous; petals elliptic, 4.8 mm. long, obtuse, slightly reflexed, ciliolate at base and apex; stamens 3.5 mm. long, the filaments stout, 1 to 1.2 mm. long, somewhat exceeding the emarginate sparsely puberulous gland, the anthers unappendaged, 1.2 mm. long, the connective scales oblong-ovate, 2.4 mm. long, obtuse, distinctly erose especially below the middle; ovary densely hispid-pilose, the placentae 1-ovulate.

TYPE LOCALITY: Between Guanai and Tipuani, Bolivia.

SPECIMENS EXAMINED:

BOLIVIA: Guanai to Tipuani, Province of La Paz, April to June, 1892, *Bang* 1337 (type collection; G, N, Y).

Rusby also refers *Spruce* 1855b to this species.

33. *Rinorea scandens* Ule, Verh. Bot. Ver. Brand. 47: 157. 1905.

Scandent; branchlets ferruginous-puberulous; leaves opposite; petioles 5 to 10 mm. long; blades ovate-elliptic or oblong, 15 to 20 cm. long, 6 to 9 cm. wide, acuminate, subentire or slightly serrulate, pubescent on the veins especially above; racemes puberulous, 4 to 6 cm. long; pedicels 2 mm. long; sepals broadly triangular, acute, cordate; petals lance-ovate, 3.5 mm. long; stamens 3 mm. long, the filaments 1 mm. long, the connective scales lance-ovate, 2 mm. long, erose, about twice as long as the anthers; ovary densely pubescent; capsule oblong, 2 cm. long, acuminate, puberulous; seeds 2 to each valve, glabrous.

TYPE LOCALITY: Lower Rio Juruá, near Marary and Bom Fim, Province of Amazonas, Brazil. Type collected by Ule (no. 5018).

Not seen; description taken from the original.

34. *Rinorea deflexiflora* Bartlett, Proc. Amer. Acad. 43: 56. 1907.

Shrub 2.5 meters high; branchlets sparsely hispid-pilose, glabrate; leaves opposite or ternate; petioles sparsely puberulous, 2 to 5 mm. long; blades obovate, mostly 13 to 23.5 cm. long, 4 to 8 cm. wide, acuminate, at base unequal and subcordate, remotely mucronulate-serrate, nearly membranaceous, puberulous on costa above, tufted in the axils beneath; racemes sordid-puberulous, 4 to 6 cm. long, the pedicels 4 to 6 mm. long; sepals ovate or oblong-ovate, 1.8 to 2.5 mm. long, acute, ciliolate, rather densely strigillose at least along midline; petals oblong-ovate, 4.2 to 4.8 mm. long, obtuse, sparsely ciliolate at the reflexed apex; stamens 3.3 to 3.7 mm. long, glabrous, the filaments slender, 1.2 to 1.5 mm. long, twice as long as the broader bidentate basal gland, the anthers 1 to 1.3 mm. long, unappendaged, the connective scales elliptic-oblong, 2 to 2.2 mm. long, obtuse, erose especially below; ovary globose, densely hispid-pilose, the placentae 2-ovulate.

TYPE LOCALITY: Livingston, Guatemala.

SPECIMENS EXAMINED:

GUATEMALA: Livingston, February 18, 1905, *Deam* 61 (type collection; G, N).

A very distinct species, readily recognized among North American species by its large obovate leaves and long filaments.

35. *Rinorea pubipes* Blake, sp. nov.

Branchlets densely puberulous and more sparsely hispid-pilose with rufid hairs, glabrescent; leaves opposite; petioles pubescent like the branchlets, 3 to 5 mm. long; blades oblong-elliptic or obovate-elliptic, 9 to 12.5 cm. long, 3 to 4.5 cm. wide, abruptly acuminate, at base cuneate or rounded-cuneate, crenate-serrulate, papery, puberulous on costa above or glabrate, beneath along the costa and the 8 to 10 pairs of lateral veins densely puberulous and more sparsely hispid-pilose; racemes about 6 cm. long, densely sordid-puberulous; pedicels 1.5 to 2 mm. long; sepals orbicular-ovate, 1.2 mm. long, obtuse or apiculate, not striate, ciliolate and densely strigillose at least along midline; petals lance-oblong, 4.2 mm. long, ciliolate below, with obtuse reflexed apex; stamens 3 mm. long, glabrous, the slender filaments 0.8 mm. long, equaling or somewhat exceeding the broader emarginate gland which is free from

about the middle, the anthers unappendaged, 1.2 mm. long, the connective scales ovate, 2.2 mm. long, obtuse, somewhat erose below; ovary densely hispid-pilose, the placentae 1-ovulate; capsule 15 mm. long, puberulous and sparsely hispid-pilose, 3-seeded, the placentae puberulous; submature seeds glabrous, 6 mm. long.

Type in the U. S. National Herbarium, no. 578517, collected at Zent Farms, about 20 miles west of Puerto Limón, Costa Rica, by H. Pittier, the date not specified.

36. *Rinorea squamata* Blake, sp. nov.

Tree about 5 meters high; branchlets densely puberulous and hispid-pilose, tardily glabrate; leaves opposite; petioles pubescent like the branchlets, 3 mm. long; blades elliptic-obovate, 6.5 to 10.5 cm. long, 2.3 to 3.8 cm. wide, rather abruptly caudate-acuminate, at base rounded or truncate-rounded, crenate-serrulate, papery, puberulous on costa and sometimes on veins above, sparsely strigose or hispid-pilose on costa and sometimes on the 6 to 8 pairs of veins beneath; racemes about 5 cm. long, rufid-puberulous and hispid-pilose; pedicels 1.5 mm. long; sepals ovate to suborbicular-ovate, 1.5 mm. long, slightly apiculate, ciliolate, rufid-pubescent above at least along midline, not striate; petals oblong, 3.5 mm. long, ciliolate below, with obtuse reflexed apex; stamens 3 mm. long, the filaments 0.8 mm. long, rather broad, slightly exceeded by the broader oblong truncate gland (this free from near the middle), the anthers unappendaged, 1.2 mm. long, the connective scales oval-oblong, 2.2 mm. long, obtuse, entire or obscurely erose below; ovary densely hispid-pilose, the placentae 1-ovulate; capsule puberulous and sparsely hispid-pilose, glabrescent, 2 cm. long.

Type in the U. S. National Herbarium, no. 690300, collected near Gatún, Canal Zone, Panama, February 10, 1911, by E. A. Goldman (no. 1864).

ADDITIONAL SPECIMEN EXAMINED:

PANAMA: Marraganti and vicinity, altitude 60 meters or less, 1908, *Williams* 1031 (Y).

Closely related to *R. pubipes*, but distinguished by its oval connective scales, and leaves not puberulous on the veins beneath.

37. *Rinorea pilosula* Blake in Standl. Contr. U. S. Nat. Herb. 23: 838. 1923.

PLATE 37.

Branchlets densely and finely spreading-pilosulous, glabrate; leaves opposite; petioles densely pilosulous or puberulous, 3 to 7 mm. long; blades oval or ovate-oval, 7.5 to 11.5 cm. long, 3.2 to 5.2 cm. wide, short-pointed, at base rounded-cuneate or cuneate, obscurely crenate or rather coarsely crenate-serrulate, papery, puberulous on costa above, beneath sparsely hispidulous along costa or glabrous; racemes 3 to 7.5 cm. long, densely sordid-puberulous with spreading hairs; pedicels 3 to 5 mm. long; sepals ovate or oval-ovate, 1.2 to 1.7 mm. long, acutish, ciliolate, puberulous at least along midline, not striate; petals elliptic-ovate or lance-ovate, 5 mm. long, narrowed to an obtuse reflexed apex, sparsely ciliolate, rarely with a very few hairs on back; stamens 3.8 to 4.2 mm. long, the filaments 0.7 mm. long, slightly exceeded by the emarginate or entire sometimes sparsely ciliate gland, this free from near the middle, the anthers 1.8 mm. long, unappendaged, the connective scales lance-ovate or elliptic-ovate, 3.1 to 3.5 mm. long, narrowed to an obtuse apex, entire or obscurely erose below; ovary and base of style densely hispidulous-pilosulous, the placentae 1-ovulate.

Type in the U. S. National Herbarium, no. 40190, collected at El Macayel, near San Juan Bautista, Tabasco, Mexico, February 1, 1888, by J. N. Rovirosa (no. 100).

ADDITIONAL SPECIMEN EXAMINED:

MEXICO: Without definite locality, *Kerber* 407 (N).

Related to *R. guatemalensis*, but distinguished by the entire lack of appendages to the anther sacs, even in the bud, and by the entire or subentire connective scales.

EXPLANATION OF PLATE 37.—*Rinorea pilosula*, from the type specimen. Natural size.

SPECIES OF UNCERTAIN POSITION.

38. *Rinorea albicaulis* (Turcz.) Blake.

Alsodeja albicaulis Turcz. Bull. Soc. Nat. Moscou 36¹: 558. 1863.

Shrub, white-barked, glabrous; leaves opposite, lanceolate, acuminate, subsessile, membranaceous, sharply serrate; racemes many-flowered, slightly shorter than the leaves; petals contorted at apex, twice as long as the sepals; stamens united into an urceole.

TYPE LOCALITY: Chiquitos, Bolivia. Type collected by D'Orbigny (no. 987).

Known to me only from the original description. The species is evidently distinct from *R. gracilis* and *R. viridifolia* Rusby, the only other species known from Bolivia.

39. *Rinorea gracilis* Rusby, Bull. N. Y. Bot. Gard. 8: 106. 1912.

Slender shrub, about 2 meters high; branchlets rufous-hispid and finely puberulous, glabrescent; leaves opposite; petioles pubescent like the branchlets, 3 to 5 mm. long; blades obovate or elliptic-obovate, 5 to 9 cm. long, 2.2 to 3.5 cm. wide, short-pointed, acutely cuneate at base, puberulous on costa above, beneath sparsely strigose on costa or glabrous, obsoletely crenate, papyraceous; racemes puberulous, about 4.5 cm. long; ovary densely rufous-hispid; capsule glabrescent, 17 mm. long; placentae glabrous.

SPECIMEN EXAMINED:

BOLIVIA: San Buenaventura, altitude 455 meters, November 24, 1901, *Williams* 611 (type; Y, photograph and fragment N).

Rusby also refers to this species a specimen collected by Spruce at Tarapota. The material is not sufficiently complete to indicate to what group of the genus the species belongs.

DOUBTFUL SPECIES.

ALSODEIA CAMPTONEURA Radlk. Sitzungsab. Math. Phys. Akad. Wiss. München 20: 186. 1891.

Based on *Spruce* 1964 and 1069. The species is said to be allied to *A. falcata*, to which these collections were referred by Eichler. The fragmentary description given does not suffice for separation.

ALSODEIA JAPURANA (Meisn.) Radlk. Sitzungsab. Math. Phys. Akad. Wiss. München 20: 182. 1891.

Coccoloba japurana Meisn. in Mart. Fl. Bras. 5¹: 25. 1855.

This was described from specimens with very young flowers. It is said by Radlkofer to be allied to *A. racemosa*.

ALSODEIA PALLIDA Klotzsch; Schomb. Versuch Fauna & Fl. Br. Guian. 1165. 1848, nomen nudum.

ALSODEIA RAMIZIANA Glaz. Bull. Soc. Bot. France 52: Mém. 3: 22. 1905, nomen nudum.

Glazou 12425 is cited, but no description is given.

EXCLUDED SPECIES.

ALSOIDEIA LONGIFLORA Oudem. Arch. Néerl. **2**: 195. pl. 5. 1867; in Miquel, Ann. Mus. Bot. Lugd. Bat. **3**: 68. 1867.

This is evidently a species of *Amphirrox*, related to *A. surinamensis* Eichl. and *A. juruana* Ule in its elongated anther appendages, but distinguished by its much smaller flowers only 9 mm. long. The species becomes ***Amphirrox longiflora*** (Oudem.) Blake. The specific name is very inappropriate, as the flowers are the smallest known in the genus. No specimens have been examined.

ALSOIDEA MEGAPOTAMICA Spreng. Syst. Veg. **4**: Cur. Post. 99. 1827.

According to Garcke,¹³ who examined an original specimen, this is *Dalbergia variabilis* Vogel.

ALSOIDEIA PARVIFOLIA S. Wats. Proc. Amer. Acad. **25**: 142. 1890.

This is *Hybanthus mexicanus* Ging.¹⁴ The type and much other material have been examined.

ALSOIDEA PERRINI Spreng. Syst. Veg. **1**: 807. 1825.

Garcke examined an original specimen and reports¹⁵ that this does not belong to the Violaceae, but is probably one of the Apocynaceae, perhaps *Echites*.

ALSOIDEA PIPAREA Spreng. Syst. Veg. **1**: 807. 1825.

Piparea dentata Aubl. Pl. Gulan. **2**: App. 31. pl. 386. 1775.

Conohoria aubletii D. Dietr. Syn. Pl. **1**: 831. 1839.

This is a species of *Casearia*.

ALSOIDEIA REGNELLII (Miquel) Walp. Ann. Bot. Syst. **2**: 67. 1851-52.

Conohoria regnellii Miquel, Linnaea **22**: 555. 1849.

According to Eichler,¹⁶ this is identical with *Ionidium atropurpureum* St. Hil.

CONOHORIA ALTERNIFOLIA Spreng. Neue Entd. **2**: 151. 1821.

Rinorea? integrifolia Ging. in DC. Prodr. **1**: 313. 1824.

Alsodeia integrifolia Steud. Nom. Bot. ed. 2. **1**: 64. 1840.

Having 1-flowered axillary peduncles, this can not be a *Rinorea*. Garcke¹⁷ considers the species indeterminable.

RINOREA CUSPA (H. B. K.) Baill. Hist. Pl. **4**: 346. 1873.

Conoria? cuspa H. B. K. Nov. Gen. & Sp. **7**: 242. 1825.

According to Eichler, this is certainly not one of the Violaceae, but the flowers are too young to determine its real relationship. The bark and leaves of this species are used as a febrifuge.

¹³ Bot. Zeit. **25**: 14. 1867.

¹⁴ In DC. Prodr. **1**: 312. 1824.

¹⁵ Bot. Zeit. **25**: 14. 1867.

¹⁶ In Mart. Fl. Bras. **13**: 372. 1871.

¹⁷ Bot. Zeit. **25**: 14. 1867.



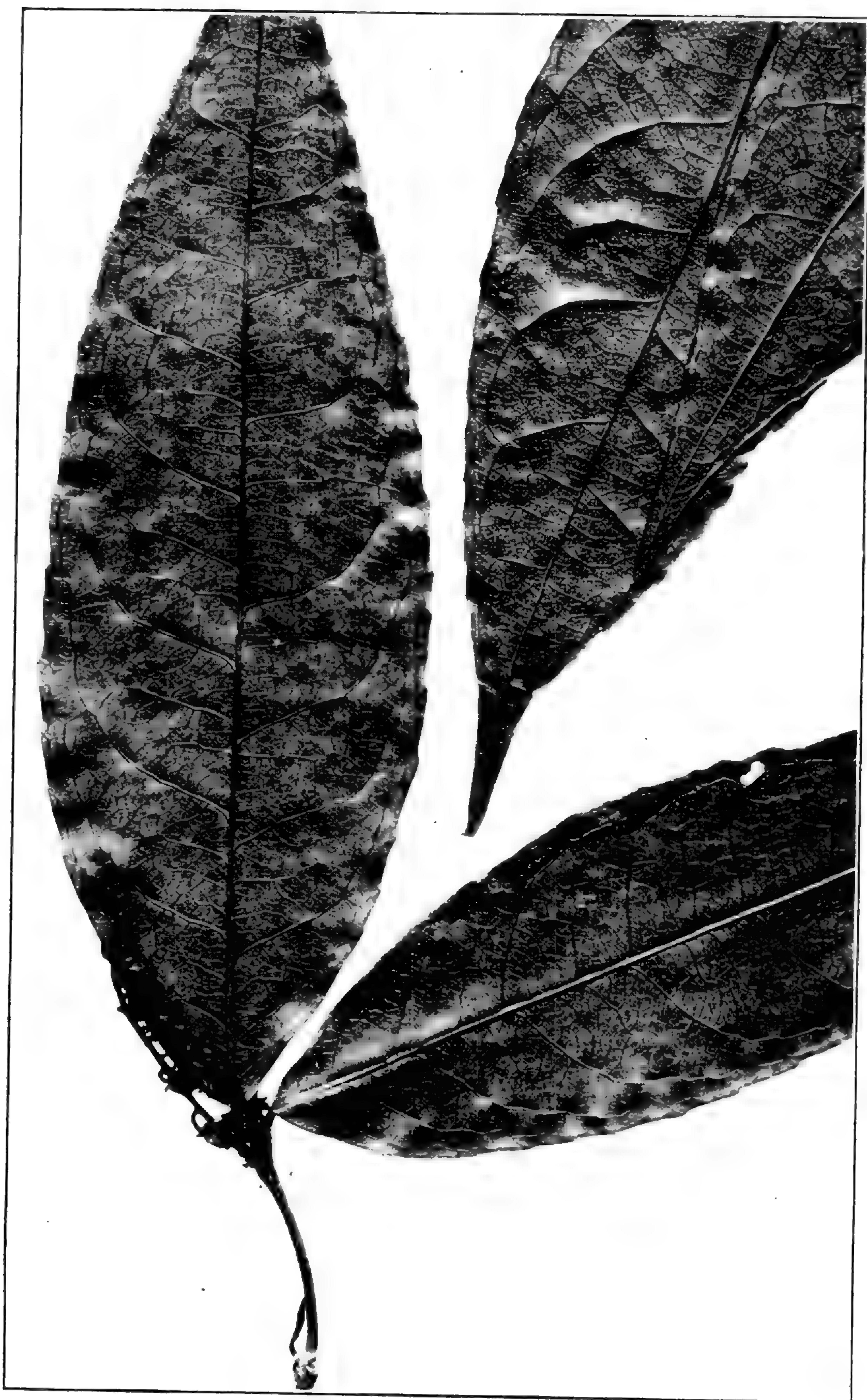
RINOREA DICHOTOMA RUSBY



RINOREA RIANA (DC.) KUNTZE



RINOREA HYMENOSEPALA BLAKE



RINOREA BRACHYTHRIX BLAKE



RINOREA MELANODONTA BLAKE



RINOREA OVALIFOLIA (BRITTON) BLAKE



RINOREA PILOSULA BLAKE

NEW PLANTS FROM VENEZUELA.

By S. F. BLAKE.

At intervals during the last nine years Mr. Henry Pittier, until recently a member of the staff of the United States Department of Agriculture, has made large collections of plants in Venezuela. His specimens, amounting to several thousand numbers, although as yet only partly identified, have added largely to our knowledge of the flora of that country. The new species collected by Mr. Pittier and described in the present paper are derived in part from his earlier collections and in part from the material forwarded by him since his return to Caracas in 1919.

Nearly half of the new species here described are from the small but very interesting collections made by Dr. Alfredo Jahn in the high páramos of Táchira and Mérida at various dates during the past dozen years. Several new species collected by Dr. Jahn were described a few years ago by Mr. Paul C. Standley, but a considerable amount of the material has remained unnamed, and many species not before represented have been found in Dr. Jahn's recent collections.

Of the new plants here described the most interesting are three of the Asteraceae. *Riencourtia ovata* belongs to a genus new to Venezuela, and *Otopappus australis* to one new to South America. *Podocoma bartsiaefolia* is the only northern representative of a genus with several species in Brazil, extending into Uruguay and Paraguay, and a single outlier in Australia.

The description of a new moss collected by Mr. Pittier and named by Mr. R. S. Williams is included in this paper at the request of the author.

ERPODIACEAE.

Erpodium latifolium R. S. Williams, sp. nov.

PLATE 38.

Autoicous, the male flowers ovate, about 0.25 mm. long, with 1 to 3 antheridia and few or no paraphyses, the antheridial leaves small, ovate, obtuse. Plants in thin loose mats, the depressed stems scarcely 1 mm. wide and mostly less than 1 cm. long, bearing scattered radicles beneath; leaves ecostate, entire, broadly ovate with rounded apex, finely papillose on both sides almost to the base in 4 rows, the dorsal leaves up to about 0.6 mm. long, recurved on one

side below, more or less papillose on the margin, the ventral leaves very similar to the dorsal but much smaller; leaf cells at apex often about $8\ \mu$ square, half-way down the leaf becoming elongate-hexagonal, the basal on one side often somewhat transversely elongate, on the other side square to elongate, those between often rectangular and up to 25 or $30\ \mu$ long; perichaetial leaves small, obtuse, scarcely imbricate; capsule exserted on a short pedicel, oblong-cylindric, 1 mm. long or less without lid, the latter acutely pointed, its height sometimes considerably exceeding its basal diameter; exothecal cells more or less rectangular, about $20\ \mu$ wide and up to $40\ \mu$ long, with thin walls; stomata, annulus, and peristome apparently lacking; spores minutely papillose, 25 to $28\ \mu$ in diameter.

Type in the herbarium of the New York Botanical Garden, collected on bark with *Stereophyllum radiculosum*, Bosque de Catuche, near Caracas, Venezuela, altitude $1,000$ meters, January 22, 1922, by H. Pittier (no. 10080a). Duplicate in the U. S. National Herbarium.

This species seems to be most closely related to *Erpodium domingense*, but the leaves are larger, more rounded, and less densely papillose, and the lower leaf cells are mostly not transversely elongate.

EXPLANATION OF PLATE 38.—*Erpodium latifolium* R. S. Williams. Fig. a, Part of fruiting stem, scale 18; b, dorsal stem-leaf, scale 40; c, ventral stem-leaf, scale 40; d, apex of dorsal leaf, scale 200; e, g, alar cells on opposite sides of dorsal leaf, scale 200; f, intermediate basal cells of same, scale 200. From the type specimen.

LACISTEMACEAE.

Lacistema pittieri Blake, sp. nov.

Tree 4 meters high; branches slender, strigose; leaves alternate; petioles strigose, 4 to 6 mm. long; blades oval-oblong or obovate-oval, 10 to 12 cm. long, 3.8 to 4.8 cm. wide, rather abruptly acuminate (the point acute, 1.5 cm. long), at base rounded-cuneate, subchartaceous, above deep green, somewhat shining, glabrous, beneath duller green, pilose with ascending or spreading hairs along the costa and the 6 pairs of lateral veins, glabrous on surface, the secondaries straightish, prominulous on both sides; racemes in axillary clusters of 1 to 3 , sordid-hispidulous, 2 to 2.5 cm. long, 3 to 4 mm. thick, rather loosely flowered; bracts 2 subtending each flower, the lower triangular, pubescent, 0.7 mm. long, the upper tubular-campanulate, essentially glabrous, deeply bifid, 0.8 mm. long; pedicels glabrous, 1.5 mm. long; sepals 4 , ovate, 0.9 mm. long, obtuse, obscurely serrulate, glabrous; disk thick, annular; stamen 1 , glabrous, the stout subulate filament 0.5 mm. long, the connective dilated, the anther cells divergent; ovary densely hispid-pilose, the placentae 3 , each bearing 2 ovules; style none; stigmas 3 , about half as long as the ovary.

Type in the U. S. National Herbarium, no. 1,056,630, collected on the Upper Guaremales, on road from Puerto Cabello to San Felipe, Carabobo, Venezuela, altitude 450 meters, in forest, July 12, 1920, by H. Pittier (no. 8974).

Perhaps nearest *Lacistema poeppigii* A. DC., but distinguished, according to description, by its longer pubescence and by the more numerous veins of the leaves.

SILENACEAE.

Cerastium cephalanthum Blake, sp. nov.

Cespitose herbaceous perennial, densely short-pilose throughout with several-celled subglandular hairs, only slightly viscid; sterile basal branches several, about 4 cm. long, very densely leafy; stems simple or subsimple, erect, 17 to 30 cm. high, bearing 3 to 6 pairs of leaves above the base, the internodes 2 to 9 cm.

long; leaves linear-lanceolate, 2.5 to 4 cm. long, 3 to 5 mm. wide, acuminate to an obtusish apex, sessile, 1-nerved (the costa impressed above, prominulous beneath), erect, scarcely revolute-margined, the lower marcescent, the uppermost pair usually abruptly reduced; peduncle terminal, 4.5 cm. long or less, bearing a single dichotomous capitate cyme about 1.5 cm. high and 1 to 1.8 cm. thick; bracts ovate, the outermost about 8 mm. long; pedicels becoming 6 mm. long or less; sepals 5, oblong or ovate-oblong, 7.5 mm. long, 2 to 2.5 mm. wide, obtuse or acutish, apiculate, about 3-nerved, herbaceous, the inner with somewhat erose hyaline margin, densely spreading-pilose with several-celled, usually gland-tipped hairs; petals white, cuneate, emarginate, 11 mm. long, 4 mm. wide, marcescent; stamens 10, the filaments glabrous, becoming 5 mm. long; ovary subglobose, many-ovuled; styles 5 or sometimes 6; capsule subcylindric, 7 mm. long, about 2.5 mm. thick, 5-valved, the valves bifid, the teeth revolute; seeds (immature) pale brown, irregularly roughened, about 0.6 mm. long.

Type in the U. S. National Herbarium, no. 1,069,159, collected on the Páramo de Timotes, Mérida, Venezuela; altitude 4,200 meters, September 4, 1921, by Alfredo Jahn (no. 581). Also collected by Dr. Jahn (no. 66) at the same locality, altitude 4,000 meters, December 6, 1910.

Related to *Cerastium kunthii* Briq. (*C. glutinosum* H. B. K., non Fries) and *C. venezuelanum* Briq., but distinguished from both, according to description, by its closely capitate inflorescence, in addition to minor differences in floral details. The dense hairs clothing the stem and leaves are brownish, about 0.2 to 0.5 mm. long, and lack glandular tips; those of the sterile shoots are in part white and as much as 1 mm. long.

***Arenaria jahnii* Blake, sp. nov.**

Densely caespitose, procumbent perennial, the stems branching, 2 to 6 cm. long, slender, densely leafy, glabrous or slightly glandular-papillose in the grooves; leaves narrowly elliptic-lanceolate or lanceolate, 4 to 6 mm. long, 1 to 1.3 mm. wide, acuminate and submucronate, sessile and shortly connate at base and there somewhat puberulous, somewhat revolute-margined, fleshy, pale green, 1-nerved, glabrous or sparsely ciliate at base; peduncles solitary, terminal, becoming pseudo-axillary, 1-flowered, puberulous toward apex, 5 to 8 mm. long; sepals 5, oblong-ovate, 4 mm. long, acutish or obtusish, mucronulate, rather fleshy, narrowly thin-margined, glabrous, 1-nerved and with 1 or 2 pairs of weak lateral veins; petals 5, white, oblong, 3.5 mm. long, obtuse, entire; stamens 10, alternately unequal, the longer equaling the sepals; ovary globose; styles 3, equaling the ovary.

Type in the U. S. National Herbarium, no. 1,069,165, collected on the Páramo de la Sal, Mérida, Venezuela, altitude 3,400 meters, September 2, 1921, by Alfredo Jahn (no. 625).

Arenaria serpens H. B. K., apparently the closest relative of *A. jahnii*, is easily distinguished by its conspicuously ciliolate leaves.

***Drymaria paramorum* Blake, sp. nov.**

Base not seen; stems apparently procumbent, about 25 cm. long, slender, glabrous; internodes mostly 6 to 17 mm. long; leaves opposite; stipules lacerate, about 1 mm. long; petioles 1 to 3 mm. long, pilose with several-celled hairs; blades suborbicular-ovate, 6 to 10 mm. long, 5 to 8 mm. wide, obtuse or acutish, mucronulate, at base subcordate or truncate-rounded, submembranous, above sparsely pilose with loose several-celled hairs, beneath somewhat paler green, more densely pilose, ciliate, quintuplinerved; flowers 3 to 5, in a usually dichotomous terminal cyme; bracts ovate, 1.5 to 2 mm. long, obtuse, scarious, somewhat pilose; pedicels 2.5 to 4 mm. long, becoming deflexed, sparsely short-pilose; sepals 5, oval, rounded or very obtuse, the 2 outer 3.5 mm. long, green

with narrow scarious margin, weakly 3-veined, rather densely pilose with several-celled spreading hairs chiefly below the middle, the 3 inner similar but more broadly scarious-margined, 4 mm. long, nearly or quite glabrous; petals 5, white, cuneate, bifid to below the middle, 5 mm. long, persistent; stamens 5, slightly surpassing the pistil; ovary about 22-ovuled; style short, shorter than the 3 stigmatic branches; capsule ovoid, obtuse, about 4 mm. long, slightly surpassing the sepals, shorter than the petals; seeds blackish brown, bluntly muriculate, 1.2 mm. long.

Type in the U. S. National Herbarium, no. 602305, collected on the Páramo de la Cristalina, Trujillo, Venezuela, altitude 2,900 meters, October 20, 1910, by Alfredo Jahn (no. 111).

A species of the *Drymaria cordata* group, apparently nearest the Peruvian *D. pauciflora* Bartl. In that species, known to me only from description, the calyx is glabrous and scarcely a line long, the petals are shorter than the sepals, the stamens are 2 or 3, and the capsule is nearly twice as long as the calyx.

BRASSICACEAE.

Draba chionophila Blake, sp. nov.

PLATE 39.

Herbaceous perennial; root napiform, densely clothed above with the persistent leaf bases, 11 cm. long or more, 2.5 cm. thick above (including the persistent leaf bases); leaves innumerable in a dense basal tuft, narrowly linear-subulate or linear, 3 to 5 cm. long, 1.5 to 2.5 mm. wide at base, 1 to 1.5 mm. wide above, narrowed to an obtuse apex, sessile, entire, fleshy, flattish, slightly grooved on the upper side, glabrous, apparently glaucescent, obscurely 3-nerved toward base, nerveless above; stem 12 cm. high, stout (1 cm. thick toward base), densely branched throughout (the whole plant subglobose), densely spreading-pubescent with simple and few-branched whitish hairs about 0.7 mm. long; branch leaves and bracts subtending the lower pedicels linear-subulate, 8 to 15 mm. long; racemes many-flowered, loose below, 3 to 4 cm. long; pedicels stout, in fruit wide-spreading, 7 to 11 mm. long, pubescent like the stem, the hairs nearly all branched; sepals 4, oval, broadly rounded, 3.8 mm. long, 2.6 mm. wide, about 3-veined, pilose with simple and forked hairs along middle of back, broadly subscarious-margined; petals pale yellow (when dried), cuneate-obovate, 4.5 mm. long, 2 mm. wide, obtuse; filaments 2.5 mm. long, glabrous, with ovate swollen base; ovary glabrous; capsule elliptic, 8 to 9 mm. long, 3.8 to 4 mm. wide, glabrous, 1-nerved and prominulously feather-veined on the valves, tipped with a stout style 1.2 mm. long; seeds 6 or 7 in each cell, 2-ranked, pale brown, minutely papillose, 1.3 to 1.5 mm. long.

Type in the U. S. National Herbarium, no. 602331, collected in snow on the Sierra Nevada of Santo Domingo, Mérida, Venezuela, altitude 4,500 meters, December 11, 1910, by Alfredo Jahn (no. 136).

This species belongs either to the section *Arbusculae* or the apparently scarcely distinct section *Volcanicae* of Gilg,¹ and is at once recognizable by its linear-subulate, fleshy, glabrous leaves. The vernacular name is given as "araña."

EXPLANATION OF PLATE 39.—*Draba chionophila*, from the type specimen. Natural size.

FABACEAE.

Bauhinia caudigera Blake, sp. nov.

PLATE 40.

Shrub or small tree, unarmed; branchlets slender, glabrous, grayish; petioles glabrous, 10 to 17 mm. long; leaf blades ovate, 10 to 14 cm. long, 3

¹ Bot. Jahrb. Engler 40: Beibl. 90: 39. 1907.

to 6.2 cm. wide, entire, caudate-attenuate (the point 0.7 to 2.5 cm. long, 2 to 4 mm. wide), cuneate to broadly rounded at base, 5-nerved, above deep green, slightly lucid, glabrous, beneath paler green, obscurely strigillose along the base of the veins, prominulous-reticulate on both sides; inflorescences axillary, essentially glabrous, the axis 2 cm. long or less, several-flowered; bracts roundish, ciliolate, 1 mm. long; pedicels glabrous, about 7 mm. long; calyx glabrous, in flower 4 cm. long, the narrowly campanulate tube 1 cm. long, the limb spathaceous, splitting irregularly; petals cuneate-oblongate, white, rounded at apex, 4.2 cm. long, 1.2 cm. wide; stamens 10, all fertile, inserted at apex of calyx tube, alternately unequal, the filaments united at base, the longer ones 3.7 cm. long, the shorter 2.8 cm., the anthers 7 to 8 mm. long; pistil free throughout, glabrous, 5.3 cm. long, the ovules about 16; fruit (submature) linear, glabrous, 21 cm. long, 1.5 cm. wide, on a stipe 2.3 cm. long.

Type in the U. S. National Herbarium, no. 1,065,082, collected in monsoon forest at Guaremales, on road from Puerto Cabello to San Felipe, Carabobo, Venezuela, altitude 10 to 100 meters, May 20 to June 10, 1920, by H. Pittier (no. 8851).

ADDITIONAL SPECIMEN EXAMINED:

VENEZUELA: Forested hills of Guaremales, road from Puerto Cabello to San Felipe, altitude 350 meters, July 2, 1920, Pittier 8914.

This species belongs to the section *Pauletia*, and is related to *Bauhinia petiolata* (Mutis) Triana, which has much larger flowers and stamens longer than the petals.

EXPLANATION OF PLATE 40.—*Bauhinia caudigera*, from the type specimen. Natural size.

***Chaetocalyx retusa* Blake, sp. nov.**

Twining herb, the stem branching, slender, sparsely hispid, the hairs with swollen bases; stipules subulate, 2 mm. long; petioles sparsely pilose or hispid-pilose, 2.5 to 4.2 cm. long, the rachis 1.3 to 3 cm. long; leaflets 5, on sparsely pilose petiolules 0.5 to 1 mm. long, the blades oval or the terminal obovate-oval, 1.8 to 3 cm. long, 1 to 2 cm. wide, at apex retuse and mucronulate, at base rounded to cuneate, membranaceous, sparsely pilose beneath at base, punctulate, the lateral veins about 5 pairs, prominulous beneath; flowers solitary or paired in the axils, the pedicels sparsely hispid-pilose toward apex, very slender, 1.8 to 2 cm. long; calyx 7 mm. long, the teeth subulate from an ovate base, ciliate and tipped with a stiff hair, the upper united about one-third their length, 3.8 mm. long, the lower 2 to 2.5 mm. long, the calyx tube 3 mm. long, each sinus, except the uppermost, with a dark-based bristle; flowers yellow; banner 12 mm. long, 10 mm. wide, the claw 3 mm. long, ciliate, the blade suborbicular, emarginate, pilosulous on back but not ciliate; lateral petals 11.5 mm. long, the glabrous claw 3.5 mm. long, the cuneate-oblongate blade obtuse, auriculate on upper side at base, ciliate (especially on lower margin and toward apex) with long white hairs, provided on outer side toward base above with four series of pockets between the veins; keel petals 11.5 mm. long, united at a short distance below the rounded apex, clawed and auriculate at base of limb, finely glandular-margined below apex; stamens glabrous; ovary short-stipitate, densely pilose like the lower portion of the style and somewhat hispid-setose, 11-ovulate.

Type in the United States National Herbarium, no. 1,065,085, collected in monsoon forest at Guaremales, on road from Puerto Cabello to San Felipe, Carabobo, Venezuela, altitude 10 to 100 meters, June 20, 1920, by H. Pittier (no. 8879).

Nearest *Chaetocalyx scandens* (L.) Urban, of the Lesser Antilles, which has rounded or very obtuse leaflets, a sparsely setuliferous, otherwise glabrous calyx 7 to 8 mm. long, and a corolla 15 to 17 mm. long.

Stylosanthes sericeiceps Blake, sp. nov.

Frutescent below, the glabrate grayish-barked stem 3 to 4 mm. thick, much branched, 30 cm. long and more; branches herbaceous, slender, erect or ascending, with many short branchlets, silky-pilose with erect hairs, these denser in lines; leaves shorter or longer than the internodes, 3-foliolate; sheath of the stipules densely silky-pilose, 5 to 7 mm. long, the stiff subulate-acicular teeth mucronate, 4 to 6 mm. long; petioles silky-pilosulous, 4 to 6 mm. long, the rachis 1 to 2 mm. long; leaflets short-petiolulate, narrowly elliptic, 1.3 to 2.3 cm. long, 1.5 to 4 mm. wide, acuminate, mucronate, at base rounded, very sparsely pilosulous or nearly glabrous above, sparsely accumbent-pilosulous beneath, firm, the costa and 4 to 7 pairs of lateral veins impressed above, prominent beneath; spikes oblong or obovoid-oblong, approximate, about 1.5 cm. long; primary bracts unifoliolate, the sheath 5 to 7 mm. long, densely silky-pilose-ciliate with whitish hairs and more sparsely silky-pilose dorsally, the teeth 4 to 5 mm. long, the blade lance-elliptic, 9 mm. long or less; secondary bract 1, bifid, ciliate, 4 mm. long; axis rudiment present in the two lowest flowers of the spike, slender-subulate, stiff, densely pilose, 1 to 3.8 mm. long, absent in the other flowers; bractlet 1, similar to the secondary bract but narrower and entire, of equal length; calyx 1 cm. long (including the stipe-like base, this 7 mm. long), the lobes ciliate; corolla yellow, the banner 8 mm. long; pod 6.5 to 7.5 mm. long, with both joints fertile, the lower obovoid-oblong, with incurved back, compressed, densely silky-pilose, 2-nerved on each side, 2.8 to 3.5 mm. long, 2 mm. wide, the upper joint similar but less densely pilose, 2.5 to 3 mm. long, 2 mm. wide, the incurved beak 1 to 1.2 mm. long.

Type in the U. S. National Herbarium, no. 1,069,160, collected at Lagunillas, Mérida, Venezuela, altitude 1,000 meters, October 6, 1921, by A. Jahn (no. 678).

Closely related to *Stylosanthes diarthra* Blake, also of Venezuela, but entirely lacking the hispidity of that species, and with longer and comparatively narrower leaflets.

Pterocarpus podocarpus Blake, sp. nov.

Tree; branches glabrous, gray-barked; leaves alternate, 11 or 13-foliolate; petiole (2.2 to 4.5 cm. long) and rachis (9 to 11 cm. long) slender, pilosulous, glabrescent; leaflets subopposite or the lower somewhat separated, petiolulate (petiolules 3 to 4 mm. long), the blades narrowly to broadly elliptic or somewhat ovate-elliptic, 6 to 8 cm. long, 2 to 4.2 cm. wide, obtuse to subtruncate or retuse, mucronate (mucro 1 mm. long), at the base rounded or cuneate-rounded, papery, above green, glabrous, beneath glaucescent, along costa and margin and sometimes along the chief veins rufous-pilose, glabrescent or glabrate, feather-veined (veins about 8 pairs, prominulous beneath, scarcely so above); racemes 1 to 3, subterminal, 5 to 10 cm. long, densely fuscous-pilosulous with ascending or erectish hairs; bracts and bractlets deciduous; pedicels 5 to (fruit) 15 mm. long, bibracteolate near apex; calyx densely fuscous-pilosulous, 9 mm. long, the 5 teeth subequal, very short, obtuse; flowers yellow, the banner with a darker central spot; banner suborbicular, the claw 3 mm. long, the lamina 11 mm. long and wide; lateral petals slightly longer than keel; staminal sheath split above; fruit obliquely ovate-suborbicular, 4.5 to 5.5 cm. long, 4 to 5 cm. wide, shortly falcate-tipped, at base truncate or subcordate, sparsely accumbent-pilose with rufescent hairs, 1 or 2-ribbed on sides, with chartaceo-coriaceous wing, reticulate-veined, unarmed, narrowly decurrent on the upper part of the stipe, this 2 cm. long; seeds 2 (or sometimes 3?).

Type in the U. S. National Herbarium, no. 987734, collected in the vicinity of Las Trincheras, near Valencia, Carabobo, Venezuela, altitude 200 to 400 meters, December 30, 1917, by H. Pittier (no. 7636).

ADDITIONAL SPECIMEN EXAMINED:

VENEZUELA: Vicinity of Perijá, Zulia, 1917, *Tejera* 81.

Somewhat related to *Pterocarpus draco* L., which has a glabrous inflorescence and pod.

Platymiscium diadelphum Blake, sp. nov.

Tree, up to 20 meters high; older branches grayish, glabrous, compressed at the nodes, those of the year blackish green, glabrous; leaves opposite, 5-foliate; stipules united, roundish, subcoriaceous, glabrous, 5 mm. long and wide; petioles of young leaves 4 cm. long, glabrous, the rachis 5 cm. long, the petiolules glabrous, 2 mm. long; blades (very immature) oblong-oval, about 3 cm. long, 1.5 cm. wide, short-pointed, at base rounded, glabrous; racemes solitary in the axils, glabrous, the peduncle 1 to 2 cm. long, the axis 4.5 to 5 cm. long; bracts lanceolate, ciliate, about 1.2 mm. long, caducous; bracteoles linear-subulate, ciliate, 1.2 mm. long, very caducous; pedicels mostly paired, glabrous, 3 to 5 mm. long; calyx campanulate, 3.8 mm. long, the two upper teeth deltoid, 0.3 mm. long, ciliate, the three lower triangular, 0.7 mm. long, ciliate; flowers brownish yellow; banner 8 to 9 mm. long, 7 mm. wide, short-clawed, the orbicular blade emarginate, glabrous; lateral petals 8 mm. long, glabrous, the claw 2 mm. long, the blade oblong-ovate, obtuse, cordate at base on upper side, subtruncate on lower side; keel petals similar but oblique on lower side at base; stamens 10, glabrous, diadelphous, the vexillar free throughout from the first; ovary long-stiped, glabrous, 2-ovulate.

Type in the U. S. National Herbarium, no. 1,065,079, collected in light forest between La Antrada and Las Trincheras, along road from Valencia to Puerto Cabello, Carabobo, Venezuela, altitude 300 to 400 meters, May 2, 1920, by H. Pittier (no. 8818).

Related to *Platymiscium floribundum* Benth., which has monadelphous stamens, oval subsistent bracteoles, larger calyx (4.8 to 5.8 mm. long) with the blunter teeth not at all or only obscurely ciliate, and corolla 12 to 14 mm. long.

Coumarouna punctata Blake, sp. nov.

Tree; branches glabrous; leaves alternate; petiole 2.5 to 4.5 cm. long, flattened and narrowly winged, 4 mm. wide, the rachis 3 to 5 cm. long, not prolonged into a point; leaflets 4, alternate, on petiolules 3 mm. long, the blades elliptic-oblong or oval-oblong, 7.5 to 14.5 cm. long, 4 to 5 cm. wide, obtuse, at base rounded on one side, oblique on the other, strongly inequilateral, coriaceous, densely translucent-punctate, obscurely glandular-papillate on the costa beneath, otherwise glabrous, finely foveolate on both sides, the lateral veins 8 to 14 pairs, somewhat prominulous on both sides, the secondaries obscure; peduncles terminal, 1.2 cm. long, like the panicle finely rufidulous-tomentellous; panicle few-branched, about 6 cm. long; bracts ovate, deciduous, densely gland-dotted, 7 mm. long, densely rufidulous-tomentellous; pedicels stout, 3 to 4 mm. long; bractlets 2, boat-shaped, equaling the bracts; calyx tube glandular-warty, densely rufidulous-tomentellous, oblique, 7 mm. long, the lower lip 2 mm. long, 3-toothed, the middle tooth longer, the two upper lobes oval-oblong, rounded, entire, 9 mm. long, equaling the corolla; banner glabrous, 8.5 mm. long, with reflexed margin and tip, thickened at base; wings 9 mm. long, oblong-oval, subcordate on upper side, the terminal mucro 1 mm. long; keel petals similar, somewhat tomentellous toward apex; ovary glabrous, curved, 0.7 mm. long; ovules solitary; style glabrous, 2.5 mm. long.

Type in the U. S. National Herbarium, no. 1,056,631, collected from cultivated plants in vicinity of Valencia, Carabobo, Venezuela, August 15, 1920, by H. Pittier (no. 9058).

ADDITIONAL SPECIMENS EXAMINED:

VENEZUELA: Cultivated, Borburata, near Puerto Cabello, July 15, 1913, *Pittier* 6464. Cultivated, Valencia, January, 1919, *Pittier* 8411.

A member of the section *Eucoumarouna*, related to *Coumarouna alata* (Vog.) Taub., which may be distinguished by its nearly glabrous calyx wings only 6 mm. long. Also close to *C. odorata* Aubl., to which two of the specimens above cited have been referred. In that species, however, according to Bentham's description,² the leaflets (usually 6 to 8) are impunctate, and the petiole is terminated by a long acumination. In *Ducke* 12185, in the National Herbarium, which agrees in these characters with Bentham's description, the pubescence of the panicle is of a much deeper brown than in the specimens of *C. punctata*.

GERANIACEAE.

Geranium sebosum Blake, sp. nov.

Perennial, about 25 cm. high or more, multicapital, the caudex 7 mm. thick below, at apex about 1.5 cm. thick (including the stipules and leaf bases); basal leaves numerous; stipules ovate-oblong, acute, brown, scarious, pilose, about 8 mm. long; petioles slender, 8 to 12 cm. long, densely spreading-pilose with lax 1-celled hairs 1.5 to 3 mm. long and between them densely stipitate-glandular with several-celled hairs about 0.5 mm. long; blades reniform-orbicular, 3 to 4 cm. wide, pergamentaceous, densely subsericeous-pubescent and stipitate-glandular like the petioles and also sessile-glandular, 5-lobed about halfway to base, the lobes broadly cuneate or cuneate-quadrate, the central one (sometimes also the two lateral) 3-toothed with obtuse teeth, or sometimes shortly 3-lobed with entire or 1 to 3-dentate lobes, the two basal and often the two lateral 2-lobed about half their length, the lobes with 2 or 3 blunt teeth; stem stoutish, erect, similarly pubescent, naked below the inflorescence; stem leaves opposite, similar to the basal but smaller, 2.2 cm. wide, their petioles about 7 mm. long, the stipules about 5 mm.; inflorescence short, trichotomous with di- or trichotomous branches, pubescent like the stem but more conspicuously stipitate-glandular; central peduncle 2 cm. long, the others usually suppressed, the pedicels paired, 1.5 to 2 cm. long; calyx densely spreading-pubescent with several-celled, mostly gland-tipped hairs about 0.8 mm. long, the sepals oval, 6 mm. long, 3 mm. wide, 3-nerved, obtusely apiculate at the broadly rounded apex (mucro 0.3 mm. long); petals apparently magenta, 9 mm. long (claw 2.5 mm.), 6 mm. wide, the limb cuneate-suborbicular, subtruncate, minutely stipitate-glandular on margin above, otherwise glabrous; filaments lance-subulate, not denticulate, pilose-ciliate and stipitate-glandular on margin nearly to apex; fruit (including styles) 15 mm. long, the beak 1 cm. long, densely pubescent like the sepals, the carpel bodies pilose with chiefly eglandular hairs; seeds (immature) minutely areolate, 2 mm. long.

Type in the U. S. National Herbarium, no. 602198, collected on the Páramo de Timotes, Mérida, Venezuela, altitude 4,000 meters, March, 1910, by Alfredo Jahn (no. 5).

A member of the section *Gracilia* R. Knuth, and nearest *Geranium holosericeum* Willd. In that species, according to Knuth's monograph, the stem is glabrescent below, and merely puberulous above; the leaves are more deeply lobed; the stipules are much longer, and the lowest are glabrous; the peduncles are much longer and only sparsely pubescent; the sepals are larger, and the petals much larger. The specific name refers to the greasy feeling of the entire plant.

² Journ. Linn. Soc. Bot. 4: Suppl. 125. 1860.

POLYGALACEAE.

Polygala retifera Blake, sp. nov.

Suffrutescent, erect, 1 to several-stemmed, simple or branched, 18 to 35 cm. high; stem and branches slender, densely pubescent with curved ascending hairs but green, a few longer straighter spreading hairs usually intermixed; leaves alternate; petioles pubescent like the stem, about 2 mm. long; blades oval or oval-ovate to elliptic, 2 to 4 cm. long, 7 to 26 mm. wide, the upper usually narrower and smaller than the lower, acute or the upper sometimes obtuse, mucronulate, at base rounded to cuneate, subchartaceous, above deep green, incurved-pubescent, in age glabrescent except along nerves and margin, beneath slightly paler green, curved-pubescent chiefly along the veins, a few spreading hairs sometimes present on costa, the chief veins 4 to 6 pairs, with the secondaries and tertiaries prominulous-reticulate especially beneath; peduncles terminal and sometimes axillary, 5 to 12 mm. long, pubescent like the stem; racemes rather loose, 3 to 6.5 cm. long, pubescent like the stem; bracts deciduous, subulate-lanceolate, acuminate, ciliate and sparsely pubescent, 2 mm. long; pedicels 2 to 3 mm. long, pubescent like the stem; "flowers dark purple, the keel white or yellowish"; sepals ovate-lanceolate, 4 to 4.2 mm. long, acuminate, ciliate and pubescent with curved spreading hairs; wings oval-ovate, 8 to 9 mm. long, 4.2 to 5.8 mm. wide, rounded, very short-clawed, sparsely spreading-pubescent, more densely so along claw and costa, 7-veined and reticulate; upper petals 6.5 mm. long, ciliate at base, sparsely pubescent within toward base, the free portion obovate-oblong, emarginulate; keel 7.5 mm. long, sparsely pubescent outside; upper part of staminal tube and base of filaments sparsely pilose; apex of style short-pubescent between the stigmata; capsule broadly oval, 9 to 10 mm. long, 7.5 to 9 mm. wide, emarginate, at base rounded or slightly cordate, short-ciliate and on the sides spreading-pubescent with short straight hairs; seeds obovoid, compressed, 4.5 mm. long, pilose; aril 1.5 to 1.8 mm. high, 2 to 2.2 mm. long dorsally, with medium-sized pilose umbo, the anterior edge vertical, the posterior dorsal horizontal or ascending at an angle of 45° or less, the margin irregularly lobed.

Type in the U. S. National Herbarium, no. 601609, collected on the old road from Caracas to La Guayra, Federal District, Venezuela, altitude 1,100 to 1,700 meters, February 28, 1913, by H. Pittier (no. 5897).

OTHER SPECIMENS EXAMINED:

VENEZUELA: Savannas, Lower Catuche wood above Caracas, altitude 1,000 to 1,200 meters, March 4, 1917, *Pittier* 7014. Lower Cotiza, near Caracas, altitude 800 to 1,290 meters, June, 1918, *Pittier* 7892. Vicinity of Valencia, altitude 400 to 800 meters, December, 1920, *Pittier* 8645.

Polygala retifera belongs in the section *Hebantha* of the subgenus *Hebeclada* next to *P. colombica* Chod. No material of the latter species has been examined, but its description indicates a plant with lanceolate leaves, attenuate at each end and not reticulate beneath, and somewhat longer and narrower (3.5 to 4.5 cm. long, 10 to 16 mm. wide), and flowers only 6 mm. long. This species was described from *Otto* 573, and its habitat was given as "Columbiae in montibus apricosis apud Caracas." so that it probably came from near the locality of *P. retifera*, and its name is a misnomer.

Specimens collected by Rose (no. 21880) at La Begonia, between Caracas and Puerto Cabello, Venezuela, in 1916, and possibly others collected by Pittier (no. 7975) at Hacienda de Cura, near San Joaquín, Carabobo, Venezuela, in 1918, may be referable to *P. columbica* Chod., but they have the leaves distinctly reticulate beneath.

***Polygala stenocarpa* Blake, sp. nov.**

Slender annual 35 to 48 cm. high, branched above; stem terete, minutely and evenly but not densely incurved-puberulous; leaves alternate except at extreme base; petioles 0.5 mm. long; blades linear, 7 to 16 mm. long, 0.4 to 1 mm. wide, cuspidate-acuminate, somewhat incurved-puberulous, 1-nerved, somewhat revolute, thickish; peduncles terminal and axillary, 5 to 17 mm. long; racemes loose, slender-cylindric, acutish, comose at apex, 2.5 to 8.5 cm. long, 5 to 7 mm. thick, the axis becoming 30 cm. long or less, pubescent like the stem; bracts ovate, attenuate, 2.4 mm. long, 1-nerved, slightly erose, purplish-tinged, deciduous; pedicels glabrous, 0.8 to 1 mm. long; flowers purplish, especially (in dried specimens) on the corolla; upper sepal ovate-oval, obtuse, 1 mm. long, glabrous, 1-nerved; lower sepals similar, narrower, oblong-oval, 1 mm. long; wings ovate, 1.8 to 2 mm. long, 0.8 to 0.9 mm. wide, obtuse, short-clawed, glabrous, 3-nerved, the lateral nerves simple, extending only to the middle; upper petals 2.3 to 2.6 mm. long, the free portion ovate, narrowed to an obtuse apex, 3-nerved; keel 2.1 to 2.3 mm. long, its crest on each side of a triangular, sometimes 2-lobed lamina and a bifid or 2-parted slender lobe; stamens 8; style and stigma shorter than ovary, the style proper dorso-ventrally flattened, scarcely equaling its excavate apex, the upper stigmatic lobe slightly tufted, barely stipitate, the lower oblique; capsules pendulous, oblong-lanceolate, 3 to 3.5 mm. long, 1.3 mm. wide, emarginulate, rounded at base, not gland-bearing; seed obconic, silky-pilose and comose, 2.2 to 3 mm. long (including coma), acuminate at base; aril fastened below the tip of the beak, 0.3 to 0.5 mm. long, its 2 lobes oblong, appressed.

Type in the U. S. National Herbarium, no. 1,038,657, collected at Hacienda de Cura, near San Joaquín, Carabobo, Venezuela, altitude 480 to 1,200 meters, August 4 to 13, 1918, by H. Pittier (no. 7976).

ADDITIONAL SPECIMEN EXAMINED:

VENEZUELA: In savannas, vicinity of Valencia, Carabobo, altitude 400 to 800 meters, August 15, 1920, *Pittier* 9035.

This species belongs in the series *Trichospermae* of *Orthopolygala*, in the group called by Chodat *Penicillatae*, among which it is readily distinguished by its fine incurved puberulence (not at all glandular), its oblong-lanceolate capsule nearly twice as long as the wings, and the size of its wings.

ERICACEAE.***Vaccinium leiandrum* Blake, sp. nov.**

Branching shrub, apparently erect; stem and branches olive-green, the younger incurved-puberulous, the older glabrate; internodes 1 to 5 mm. long; petioles puberulous above, 1.5 to 2.5 mm. long; leaf blades ovate, 8 to 11 mm. long, 4 to 6 mm. wide, acute or obtusish, at base rounded to cuneate-rounded, serrulate above the base (teeth about 7 pairs, obtusish, glandular-mucronulate), coriaceous, above blackish green, puberulous along costa or subglabrous, beneath brownish with a lighter marginal line, glabrous, the lateral veins about 4 pairs, like the costa impressed above, obscure beneath; racemes axillary, solitary, crowded toward tips of branches, about 8-flowered, essentially glabrous, the axis about 6 mm. long, the bracts deciduous, subcoriaceous, about 2 mm. long, the pedicels 2 mm. long or less; calyx campanulate, glabrous, 3 mm. long, the limb about equaling the tube, its 4 teeth deltoid, acute or obtuse; corolla subglobose-urceolate, 4.5 to 5 mm. long, glabrous, the teeth 4 or sometimes 5, obtuse, 1 mm. long, spreading or erectish; stamens apparently always 8, equaling the corolla tube, equal, 4 to 4.5 mm. long, the filaments nearly linear, glabrous or with a very few hairs above, 2.5 mm. long, the anther sacs granular,

exaristate, 1.2 mm. long, the 2 tubules 1.5 mm. long; ovary 4-celled; style 4.5 mm. long.

Type in the U. S. National Herbarium, no. 703598, collected on the Páramo de Piedras Blancas, Mérida, Venezuela, altitude 3,800 meters, March 27, 1915, by Alfredo Jahn (no. 427).

Closely related to *Vaccinium floribundum* H. B. K., in which the filaments are densely pilose-ciliate. Evidently allied also to *V. thymifolium* and *V. moritzianum* Klotzsch, both of which are included by Klotzsch in the section *Vitis-Idaea*, to which pilose filaments are ascribed in his synopsis.

Thibaudia jahnii Blake, sp. nov.

Shrub; stem angulate, essentially glabrous; petioles stout, glabrous, 3 to 8 mm. long; leaf blades elliptic or obovate-elliptic, 5 to 8 cm. long, 2 to 3.8 cm. wide, short-pointed with obtuse apex, cuneate at base, entire, thick-coriaceous, above glabrous, somewhat shining and pustulate, beneath dull brownish green, sparsely hispidulous with brownish hairs, narrowly revolute-margined, feather-veined, the chief veins about 3 pairs, impressed or obscure above, bluntly prominulous beneath; racemes axillary, solitary, subsessile, glabrous, about 10 to 16-flowered, the axis 2 to 3 cm. long; bracts ovate, deciduous, about 1.8 mm. long; pedicels 10 to 12 mm. long, glabrous, thickened at apex and articulate with calyx, bearing near base 2 subopposite ovate acute bractlets about 1.8 mm. long; calyx glabrous, campanulate, 4.5 mm. long, the limb with 5 very short, depressed-deltoid, acute or obtuse teeth; corolla subcylindric, fleshy, glabrous, 12 mm. long, the teeth 5, ovate, erect, obtusish; stamens 10, equal, 10 mm. long, the filaments linear-lanceolate, glabrous, 5.5 mm. long, the anther sacs finely granular, apiculate at base, 4 mm. long, the 2 tubules 5 mm. long; ovary 5-celled; style 11 mm. long.

Type in the U. S. National Herbarium, no. 703595, collected on the Páramo de Piñango, Mérida, Venezuela, altitude 2,600 meters, March 17, 1915, by Alfredo Jahn (no. 424).

A member of the section *Eurygania*, nearest *Thibaudia formosa* (Klotzsch) Hörold, from Mount Roraima, which has much shorter racemes (axis 6 to 8 mm. long), longer pedicels (12 to 18 mm.), and shorter corolla (8 to 10 mm.). The vernacular name of *T. jahnii* is given as "coralito," referring doubtless to the color of the flowers.

APOCYNACEAE.

Forsteronia elachista Blake, sp. nov.

PLATE 41

High-climbing shrub; branches gray, glabrous, the younger fuscous, very obscurely hirtellous, glabrescent; leaves opposite; petioles 5 to 7 mm. long, obscurely hirtellous; blades oval or oblong-oval, 6.5 to 12 cm. long, 3 to 5.7 cm. wide, obtusely short-pointed, at base broadly rounded, subcoriaceous, above dull green, glabrous, beneath brownish green, barbate in the axils, the veins about 8 pairs, like the costa impressed above, prominulous beneath, the secondaries obscure; panicles terminal, finely hirtellous, on peduncles 4 to 12.5 cm. long, pyramidal, 12.5 to 23 cm. long, 13 to 30 cm. wide, the branches spreading at right angles, with innumerable flowers, these cymose-paniculate toward the tips of the dichotomous ultimate branchlets; bracts triangular, griseous-hirtellous, 1 mm. long or less; pedicels about 1 mm. long; calyx 1.1 mm. long, densely griseous-hirtellous, the sepals oval, obtuse, about 3-glandular at base; corolla brownish black in drying, 1.5 mm. long, the tube 0.6 mm. long, glabrous, the lobes oblong-ovate, obtuse, 0.9 mm. long, griseous-hirtellous outside, hispidulous within; stamens exserted, 0.8 mm. long, the filaments 0.15 mm. long, the basal appendages of the anthers obovoid, obtuse, the apex acutish and villous.

Type in the U. S. National Herbarium, no. 1,065,091, collected on hills of Guaremales, at La Fortaleza, along road from Puerto Cabello to San Felipe, Carabobo, Venezuela, altitude 400 meters, July 2, 1920, by H. Pittier (no. 8918).

Related to *Forsteronia gracilis* (Benth.) Muell. Arg., the type collection of which has been examined. In that species the leaves are cordate at base, the main axis of the panicle is glabrous, and the corollas are 2 mm. long and 4 mm. wide. *Forsteronia elachista* has apparently the smallest flowers known in the genus.

EXPLANATION OF PLATE 41.—*Forsteronia elachista*, from the type specimen. Natural size.

ASCLEPIADACEAE.

Prestonia brachypoda Blake, sp. nov.

Scandent shrub; stem stout, densely hispidulous and more sparsely hispid with spreading or ascending, tubercular-based, rufidulous hairs; leaves opposite; petioles 5 mm. long, pubescent like the stem; blades oval, 17.5 to 19.5 cm. long, 10.5 to 12.5 cm. wide, apiculate (the point 2 to 4 mm. long), at base cordate, pergamentaceous, above deep green, along costa and nerves hispid, on surface more sparsely so or glabrate, beneath brownish green with a slight yellow tinge, very densely and rather softly pilosulous with spreading hairs, and along the veins sparsely hispid-pilose, the veins about 8 pairs, like the costa and secondaries impressed above, and with them finely prominulous-reticulate beneath; peduncle axillary, densely hispid-pilose with rufous hairs, 1.5 cm. long; flowers numerous in a capitate cluster about 4 cm. wide; pedicels densely hispidulous and hispid-pilose, 9 mm. long; sepals 5, oval, short-pointed, 11 mm. long, 5 to 6 mm. wide, rufidulous-hispidulous and hispid outside, each bearing at base within a deltoid scale 2.5 mm. long, truncate and 4-denticulate at apex, densely strigose outside; corolla yellow, salver-shaped, the tube 16 mm. long, about 4 mm. thick, densely strigose with fulvous hairs, the limb 17 mm. wide, its lobes broadly oblong, strigose on one side without; stamens inserted below apex of tube, barely exerted, the filaments 1.5 mm. long, densely ciliate, the anthers acuminate, 5.2 mm. long; corolla tube bearing below apex 5 linear truncate scales 3.2 mm. long, about twice as long as the depressed lobes of the annulus, and with a hairy ring within just above the stamens; disk 5-lobed, equaling the scales of the calyx, surpassing the ovary.

Type in the U. S. National Herbarium, no. 1,065,080, collected in forest at Guaremales, road from Puerto Cabello to San Felipe, Carabobo, Venezuela, altitude 10 to 100 meters, May 15, 1920, by H. Pittier (no. 8832).

This species is nearly related to *Prestonia surinamensis* Muell. Arg., which is described as having the leaves obtuse at base and pubescent beneath with shorter flexuous hairs, petioles 1 cm. long, and stamens inserted at about the middle of the tube. It is perhaps nearer to *P. ipomaeifolia* A. DC., which is described as having smaller and narrower leaves, acute calycine scales, calyx scarcely shorter than corolla tube, and corolla scales not longer than the corona.

Fischeria subaequalis Blake, sp. nov.

Scandent shrub; stem minutely hirtellous, more sparsely hispid with wide-spreading many-celled brown hairs; leaves opposite; petioles 3 to 4 cm. long, densely hirtellous, rarely very sparsely hispid; blades oval or obovate-oval, 9 to 14 cm. long, 5.8 to 8 cm. wide, apiculate (the tip about 2 mm. long), or rarely acute, at base cordate, the sinus usually concealed, papery or chartaceous, above dull green, densely hispidulous on both sides with spreading tuberculate-based hairs, the lateral nerves about 7 pairs, prominulous beneath, the secondaries scarcely prominulous; peduncles interaxillary, usually 11 to 15.5 cm. long.

usually exceeding the leaves, hirtellous and more sparsely spreading-hispid, sometimes bifurcate above; flowers corymbosely arranged; bracts filiform, 7 mm. long; pedicels hirtellous and sparsely hispid, 2.5 to 3 cm. long; sepals nearly equaling the corolla, lance-ovate, 12 mm. long, 3 mm. wide at base, long-acuminate, hispidulous and sparsely spreading-hispid, spreading or somewhat reflexed; corolla 2.8 cm. wide, white, deep green at base within, its lobes ovate, acute, strongly crisped at one side toward apex, short-hispid inside toward base, and outside ciliate on one margin; outer corona fleshy, about two-thirds as high as the gynostegium, its lower lobe obscurely sinuate, spreading, its upper slightly sinuate; inner corona of 5 fleshy rounded lobes; anther appendages deltoid, obtuse, appressed.

Type in the U. S. National Herbarium, no. 1,065,086, collected on border of forest near Urama, along road from Puerto Cabello to San Felipe, Carabobo, Venezuela, June 20, 1920, by H. Pittier (no. 8904).

ADDITIONAL SPECIMEN EXAMINED:

VENEZUELA: Near Alpargatón, along road from Puerto Cabello to San Felipe, April 25, 1920, Pittier 8810.

Related to *Fischeria blepharopetala* Blake, of Colombia, which has densely hispid petioles and a corolla only 2 cm. wide, with elliptic-ovate obtuse long-ciliate lobes.

Vincetoxicum lasiostomum (Decaisne) Blake.

Gonolobus lasiostomus Decaisne in DC. Prodr. 8: 593. 1844.

This species, originally described from Caracas, was collected by Mr. Pittier (no. 8858) at Guaremales, along road from Puerto Cabello to San Felipe, June 6, 1920.

RUBIACEAE.

Alseis leiantha Blake, sp. nov.

Small tree, 8 to 10 meters high; stem stout, quadrangular, pithy, sulcate, at maturity grayish, the younger branches nigrescent in drying, glabrous; stipules of each side united, lance-subulate, nigrescent, 2 cm. long, deciduous at maturity; petioles sparsely ciliate in youth, 5 to 12 mm. long; blades (the younger nigrescent in drying) narrowly elliptic-obovate, 14 to 18 cm. long, 2.5 to 4.5 cm. wide, acuminate, at base long-cuneate into the petiole, in youth sparsely ciliolate, glabrous above, beneath finely hirtellous on the veins, sparsely so on surface or glabrate, at maturity deep green and somewhat shining on both sides, glabrous except for tufts in the axils of the veins beneath, the veins 16 to 26 pairs, prominulous beneath, the secondaries few, connecting them nearly at right angles; spikes precocious, about 20 cm. long, subtended by small leaves, densely flowered, the axis densely and sordidly pilose-tomentose, in age glabrescent; bracts filiform-subulate, deciduous, about 2 mm. long; flowers sessile; hypanthium sordid-pilose chiefly below, obovoid, 3 mm. long; free portion of calyx 5-parted essentially to the base, 1.5 mm. long, the teeth lanceolate, glabrous, acute; corolla greenish-yellow, tubular-campanulate, 5.5 mm. long, glabrous outside, pilose within below the apex, the 5 teeth deltoid, subtruncate, 1 mm. long; stamens inserted at base of tube, at maturity long-exserted, the filaments densely pilose to above the middle, becoming 8 mm. long, the anthers papillose, apiculate, 1.8 mm. long; style exserted, glabrous, its undivided portion 6.5 mm. long, the branches papillose; capsules clavate, glabrescent, erect, 10 to 13 mm. long.

Type in the U. S. National Herbarium, no. 1,065,081, collected in monsoon forest at Guaremales, along road from El Palito to San Felipe, Carabobo, Venezuela, altitude 10 to 100 meters, May 29, 1920, by H. Pittier (no. 8850).

ADDITIONAL SPECIMENS EXAMINED:

VENEZUELA: Guaremales, altitude 10 to 100 meters, 1920, *Pittier* 9099.
Vicinity of Perijá, Zulia, 1917, *Tejera* 1.

This species is related to *Alseis floribunda* Schott, but has the corolla glabrous outside, the style glabrous, and the branchlets not pubescent.

As already noted by K. Schumann,⁴ the aestivation in *Alseis* is open, not valvate as described by Bentham and Hooker, and the flowers are all hermaphrodite and similar, not dimorphous and monoecious as described by Bentham and Hooker and by Hemsley.

Chomelia polyantha Blake, sp. nov.

Small tree, 5 to 6 meters high; stem sparsely strigillose, glabrate, the branchlets not spinescent; stipules united into a triangular acute strigose tooth, 2.5 mm. long; petioles 3 mm. long, sparsely strigose, ciliate; blades oval or oblong-obovate, 3 to 7 cm. long, 1.8 to 3 cm. wide, short-pointed or the smaller ones retuse, at base cuneate to rounded, coriaceous, above deep green, glabrous, beneath somewhat paler green, barbate in the axils of the veins, the veins 4 pairs, prominulous beneath, the secondaries somewhat impressed beneath; peduncles axillary, glabrous, 1.5 to 2 cm. long, at apex bearing about 10 sessile ebracteate flowers in a dense cluster; hypanthium 1.4 mm. long, sparsely strigillose; free portion of calyx 2 to 2.5 mm. long, sparsely strigillose, the tube 1.8 mm. long, the 4 suborbicular or oblong teeth 0.7 mm. long, slightly unequal, at apex obtuse or emarginate, bearing a gland on each side at base; corolla white, 2 cm. long, densely strigillose when young, the very slenderly funnelform tube and throat 1.5 cm. long, the 4 lobes oblong-ovate, obtuse, 4.5 mm. long; stamens attached just below apex of throat, barely exerted, the anthers 2 mm. long; style strongly included, glabrous, the stigmatic lobes 1.2 mm. long.

Type in the U. S. National Herbarium, no. 1,065,084, collected in monsoon forest at Guaremales, along road from Puerto Cabello to San Felipe, Carabobo, Venezuela, altitude 10 to 100 meters, May 20 to June 10, 1920, by H. Pittier (no. 8856).

This species differs from its relative, *Chomelia barbinervis* Moric. (*C. anisomeris* Muell. Arg.), in having many-flowered cymes and a calyx longer than the ovary and with subequal teeth. The flowers are described as sweet-scented.

Evea lucentifolia Blake, sp. nov.

PLATE 42.

Shrub 1 to 2 meters high; branches slender, green, glabrous; stipules united, coriaceous-herbaceous, truncate, 2 mm. high, sparsely strigose at apex, bearing on each side from near the base a stiff erect spine 5 to 8 mm. long; petioles 1 mm. long or less; blades ovate or oval-ovate, 6.5 to 10 cm. long, 3.3 to 6 cm. wide, acuminate, the apex acute, at base broadly rounded, pergamentaceous, above deep green, shining, beneath much lighter green, glabrous on both sides, the veins about 7 pairs, prominulous beneath, the secondaries loosely prominulous-reticulate; peduncles solitary, terminal, glabrous, monocephalous, 2.5 cm. long; inflorescence capitate, about 2 cm. long and thick; outer bracts 5, ovate, 1.7 to 2.1 cm. long, 6 to 10 mm. wide, acute or acuminate, cuspidulate, rounded at base, glabrous outside, white, turning purple, somewhat hispidulous inside toward base; larger inner bracts about 8, lance-elliptic, acuminate, slightly shorter than the outer; flowers about 12, adnate at base to the inner bracts; free portion of calyx 1.5 mm. long, glabrous, half longer than the glabrous hypanthium, the tube cup-shaped, 1.2 mm. long, the 5 somewhat unequal teeth subulate, 0.3 mm. long or less, rarely with intermediate denticulations; corolla

⁴ In Mart. Fl. Bras. 6^e: 186-187. 1889.

1.8 cm. long, white, glabrous outside except for the sparsely hispidulous teeth, with a pilose ring within below the insertion of the stamens, the cylindric tube 7 mm. long, the slenderly funnelform throat 7 mm. long, the 5 lanceolate acutish teeth 4.8 mm. long; style 13 mm. long, deeply 2-lobed, the lobes hairy; stamens exserted, the filaments glabrous, the anthers 3 mm. long.

Type in the U. S. National Herbarium, no. 1,065,087, collected in hilly forests at Guaremales, along road from Puerto Cabello to San Felipe, Carabobo, Venezuela, altitude 10 to 100 meters, July 2, 1920, by H. Pittier (no. 8911).

ADDITIONAL SPECIMEN EXAMINED:

VENEZUELA: Valley of Patanemo, east of Puerto Cabello, altitude 10 to 250 meters, December, 1919, *Pittier* 8653.

EXPLANATION OF PLATE 42.—*Evea lucentifolia*, from the type specimen. Natural size.

ASTERACEAE.

***Oliganthes hypochlora* Blake, sp. nov.**

Shrub or tree; branches densely and finely sordid-tomentulose, in age glabrate and gray-barked; leaves alternate; petioles slender, naked, 1 to 2 cm. long, densely and finely sordid- or cinereous-tomentulose; blades broadly ovate or ovate, the larger 11 to 14.5 cm. long, 5 to 8 cm. wide, usually long-acuminate, at base rounded or subtruncate-rounded, obscurely and remotely repand-denticulate or subentire, papery, above deep green, evenly but rather sparsely dotted with shining yellowish glands, along costa and lower portion of the veins cinereous-tomentulose, beneath paler but distinctly green, similarly gland-dotted on surface, along veins and less conspicuously along some of the veinlets densely and finely sordid-tomentulose, feather-veined, the chief veins about 7 pairs, prominulous beneath, the secondaries loosely prominulous-reticulate; panicles corymbiform, terminal, rounded or flattish, very many-headed, 4 to 19 cm. wide, usually leafy-bracted, very densely ochroleucous-tomentulose; heads cylindric, 2 or 3-flowered, about 9 mm. high in flower, 1.2 mm. thick, umbellate-fasciculate, the pedicels 2 to 6 mm. long; involucre 5.5 to 7 mm. high, strongly graduate, about 6-seriate, the outermost phyllaries triangular-ovate, about 0.8 mm. long, densely tomentulose, the others oval or oval-ovate (middle) to oblong-linear (inner), acute to obtusish, whitish-stramineous, 1-nerved, the outer somewhat tomentulose at the usually thickened apex and ciliolate, the innermost subglabrous, all often pinkish-tinged; corollas (when dried) pale rosy-purplish, sparsely glandular, 7 mm. long, the teeth linear-lanceolate, acuminate, 2.5 mm. long; achenes turbinate, about 10-nerved, glandular at base, about 1.2 mm. long; pappus of 2 or 3 narrowly linear, somewhat twisted, easily deciduous, whitish, paleaceous awns about 3.2 mm. long, and a crown of more persistent, unequal, lacerate, paleaceous, connate squamellae 1.8 mm. long or less.

Type in the U. S. National Herbarium, no. 988283, collected in the vicinity of Las Trincheras, near Valencia, Carabobo, Venezuela, altitude 200 to 400 meters, October 15, 1918, by H. Pittier (no. 8185).

ADDITIONAL SPECIMEN EXAMINED:

VENEZUELA: Limón, altitude 600 meters, August 1, 1916, *Jahn* 471.

Related to *Oliganthes acuminata* (H. B. K.) Schultz Bip., to which these specimens have been referred. In that species, however, the heads are 1-flowered, and there are no elongate deciduous awns in the pappus. The vernacular name of *O. hypochlora* is given by Dr. Jahn as "zamuro." Specimens of *O. acuminata*, agreeing perfectly with the original description of that species, have been collected by Mr. Pittier on the Upper Cotiza near Caracas (no. 9834) and near Los Teques, Miranda (no. 11245).

***Ageratum sordidum* Blake, sp. nov.**

Suffrutescent, erect, 35 cm. high and more, with few opposite erect branches; stem stoutish, about 3 mm. thick, very densely and sordidly viscid-glandular-pilose with several-celled spreading hairs, glabrescent below; internodes of main stem 0.8 to 3 cm. long; leaves opposite or ternate, pubescent like the stem, often with short leafy branches in their axils; petioles narrowly margined, 6 to 15 mm. long; blades ovate to oblong- or triangular-ovate, 1.7 to 3.2 cm. long, 7 to 15 mm. wide, obtuse, at base rounded or truncate-rounded, dentate-crenate with about 12 pairs of rounded teeth, pergamentaceous, triplinerved, the secondary veins few, prominulous beneath; panicles cymose, rounded, ternately divided, terminating stem and upper branches, 7 to about 40-headed, 2.5 to 6 cm. wide; pedicels 2 to 7 mm. long; heads subglobose, about 56-flowered, 6 to 7 mm. high, 6 to 8 mm. thick; involucre 2-seriate, subequal, 5 mm. high, the phyllaries few (about 12), oblong, short-acuminate, densely glandular-pilose and glandular-cillolate, with erectish or somewhat loose tips, about 5-nerved, the outer ones with thickened costa; receptacle naked; corollas white, stipitate-glandular on teeth and sometimes very sparsely so on tube, 3 mm. long (tube 1.2 mm., throat slender-campanulate, 1.3 mm., teeth 0.5 mm.); achenes slenderly prismatic-obconic, often somewhat curved, 5-ribbed, blackish, sparsely hispidulous, 2 to 2.5 mm. long, with conspicuous whitish carpopod; pappus of 5 oblong lacerate exaristate squamellae, connate only at very base, 0.8 mm. long.

Type in the U. S. National Herbarium, no. 602315, collected on the Páramo de Timotes, Mérida, Venezuela, altitude 3,600 meters, March 20, 1910, by Alfredo Jahn (no. 121).

A member of the section *Euageratum*, well distinguished by its suffrutescent habit, dense viscid-glandular pubescence, and exaristate squamellae.

***Podocoma bartsiaefolia* Blake, sp. nov.**

PLATE 45.

Suffrutescent, several-stemmed, 23 to 30 cm. high, densely viscid-pubescent throughout with spreading several-celled gland-tipped hairs, and sparsely spreading-pilose; stems slender, simple, erect, or ascending, densely leafy; leaves alternate, linear, 1.5 to 3.5 cm. long, 1.5 to 5 mm. wide, truncate at apex, sessile and auriculate-clasping, repand-crenate, revolute-margined, 1-nerved, dull brownish green; heads 1 to 4 at apex of stem, campanulate-subglobose, 1.8 to 2.5 cm. wide, 9 to 11 mm. high, very many-flowered, on monocephalous peduncles 1.7 to 3.2 cm. long; involucre about 3-seriate, subequal, 8 to 10 mm. high, the phyllaries linear-lanceolate, acuminate, 1 to 1.5 mm. wide, appressed, blackish green, subherbaceous, with very narrow subscarious margins; rays very numerous, several-seriate, the tube slender, 4 to 4.5 mm. long, sparsely pilose above with several-celled hairs, the whole style included, the lamina elliptic-ovate, bidenticulate, erect or spreading, 1.2 to 1.5 mm. long; disk corollas slender-funnelform, pilose at base of throat, 5.5 mm. long (tube 2.5 mm., throat 2 mm., teeth ovate, 1 mm.); achenes of ray ellipsoid-fusiform, about 6-nerved, glabrous, 3.5 to 4 mm. long, with short carpopod and slender beak (0.8 to 1.1 mm. long), the pappus bristles about 18, rufigulous, hispidulous, deciduous in groups or singly; achenes of disk infertile, linear-fusiform, 2.5 to 3 mm. long, rather obscurely beaked, 5-nerved, their pappus similar to that of the ray; style branches of hermaphrodite flowers oblong-linear, rounded, unappendaged, papillose on margin.

Type in the U. S. National Herbarium, no. 602280, collected on the Páramo de Timotes, Mérida, Venezuela, altitude 3,000 to 3,500 meters, December 6, 1910, by Alfredo Jahn (no. 86).

ADDITIONAL SPECIMENS EXAMINED:

VENEZUELA: Páramo de Piedras Blancas, Mérida, altitude 4,000 meters, March 27, 1915, *Jahn* 398. Páramo de Timotes, Mérida, altitude 4,200 meters, September 4, 1921, *Jahn* 584.

This, the only species of the genus known in America outside of Brazil, Uruguay, and Paraguay, is at once recognizable by its combination of dense glandular pubescence and wingless stem. Schultz Bipontinus's name *Moritzia glandulosa*⁵ presumably referred to this species, but no description has ever been published. *Podocoma bartsiaefolia* apparently differs from all the known species of the genus in its essentially equal involucre and ellipsoid-fusiform glabrous achenes, but I have no material of the genus for comparison aside from a single sheet of the Australian species, *P. cuneifolia* R. Br.

EXPLANATION OF PLATE 43.—*Podocoma bartsiaefolia*, from the type specimen. Natural size.

Achyrocline flavida Blake, sp. nov.

Suffrutescent, 28 cm. high, few-branched near base; stems stout, simple, densely leafy, densely tomentose-lanate with cinerascens wool, beneath the tomentum densely subglandular-puberulous; leaves crowded, erect, narrowly elliptic, 2 to 2.5 cm. long, 3 to 7 mm. wide, obtuse, obscurely short-decurrent at the scarcely narrowed base, densely tomentose-lanate like the stem, beneath the tomentum densely spreading-puberulous with subglandular hairs, 3 or obscurely 5-plinerved from base; heads very numerous, crowded in a dense terminal glomerule 3.5 cm. thick; involucre straw-yellow, 5 mm. high, slightly graduated, the phyllaries oval-oblong, obtuse or rounded, or the inner apiculate, scarious, nerveless, lanate-pilose and somewhat glandular toward base; heads 6-flowered, the pistillate flowers 3 or 4, the hermaphrodite 2 or 3; pistillate corollas tubular-filiform, at apex sparsely pubescent with short clavate gland-tipped hairs, 3.2 mm. long; hermaphrodite corollas similarly pubescent, slenderly tubular-funnelform, 3.2 mm. long; achenes (scarcely mature) 0.6 mm. long; pappus bristles 3 mm. long, deciduous in groups.

Type in the U. S. National Herbarium, no. 601978, collected in the upper belt of the southern slope of Pico de Naiguatá, Miranda, Venezuela, altitude 2,400 to 2,765 meters, May 24 to 25, 1913, by H. Pittier (no. 6243).

Apparently distinct from any published species in its single dense terminal glomerule of straw-yellow heads, its elliptic, very crowded leaves, and very dense, lanate tomentum.

Riencourtia ovata Blake, sp. nov.

PLATE 44.

Erect herbaceous perennial; root subglobose, tuberiform, about 8 mm. thick; stems solitary, simple, or with short axillary branches, about 75 cm. high, hispid with appressed or ascending tuberculate-based hairs; leaves remote, opposite, 6 or 7 pairs; petioles hispid, 3 to 5 mm. long; blades ovate or rotund-ovate, those of the middle leaves larger, 4 to 4.5 cm. long, 2 to 2.8 cm. wide, acute or obtusish, at base broadly rounded or subcordate, papyraceous, crenate-serrate with about 9 pairs of teeth, nearly equally green on both sides, hispid-pilose both sides with ascending or somewhat spreading hairs, those on the upper surface tuberculate-based, triplinerved from the base; glomerules ternate at tip of stem, subsessile or on peduncles up to 4 cm. long, subglobose, 8 to 13 mm. thick, each composed of about 12 sessile heads, subtended by one or two lanceolate herbaceous bracts about 7 mm. long; heads obovoid, 5 mm. long, 4 mm. thick; phyllaries 6, the 4 outer subequal, broadly obovate-oval, 4.5 mm. long, subscarious, strigose above, obscurely callous-mucronulate at the broadly

⁵ Baker in Mart. Fl. Bras. 6^a: 14. 1882, nomen nudum.

rounded apex, the two inner similar but smaller; female flower solitary, the corolla white, tubular, 2.3 mm. long, 5-toothed (two of the teeth united for half their length), bearing a few long hairs at tip; style equaling corolla; hermaphrodite flowers 8, white, tubular-funnelform, 1.6 mm. long, 5-toothed, the tube and throat marked with 5 black lines, the teeth 0.7 mm. long, hispid; achene oval, 3.2 mm. long, 2.6 mm. wide, pilose above, lenticular in cross section, olivaceous; sterile ovaries densely intricate-pilose, linear, becoming 4 mm. long.

Type in the U. S. National Herbarium, no. 1,056,632, collected in savannas near Valencia, Carabobo, Venezuela, August 15, 1920, by H. Pittier (no. 9060).

This species is of interest as the first member of the genus to be found in Venezuela, the others ranging from the Guianas to Brazil. It may easily be distinguished from the previously known species by its ovate leaves.

EXPLANATION OF PLATE 44.—*Riencourtia ovata*, from the type specimen. Natural size.

***Espeletia marcescens* Blake, sp. nov.**

Caudex stout, up to 5 meters high, 2 cm. thick above, densely accumbent-pilose, very leafy above, denudate below; leaves densely crowded, oblong-ob lanceolate or oblong-obovate, 26 to 35 cm. long, 5 to 6 cm. wide, obtuse or acute, gradually narrowed to an abruptly ampliate sheathing base, minutely denticulate throughout (teeth 5 to 7 mm. apart), pergamentaceous, not revolute-margined, above deep green, rather densely rufid-hispidulous, glabrescent except along costa, beneath dull brownish green, gland-dotted and rather sparsely hispidulous, closely feather-veined (chief veins 80 pairs or more) and very densely prominulous-reticulate beneath, the veins and veinlets obscure or impressed above; flowering stems 45 cm. high and more, branched, striate, sordidly short-hispid-pilose with glandular-tuberculate-based hairs, more densely so in the inflorescence, leafy; stem leaves alternate or the upper rarely opposite, oval to elliptic-oblong, 5 to 13.5 cm. long (including the short or obsolete, margined petiole), 2.5 to 4.5 cm. wide, apiculate, cuneate-rounded at base, denticulate, or the upper entire, pubescent like the basal leaves, the uppermost smaller, about 2.5 cm. long; heads numerous (11 to 17 per stem), cymose-panicled, nodding, "white," 2.8 cm. wide in flower, 3.5 to 4 cm. wide at maturity; peduncles 2.5 to 11.5 cm. long, monocephalous; disk 1.5 to (fruit) 2.8 cm. wide, about 1 cm. high; involucre 2-seriate, obgraduate, 1.2 to 2 cm. high, the outer phyllaries about 6, broadly ovate, acutish, foliaceous, veiny, densely glandular-tuberculate and sparsely hirsute, the inner shorter; rays about 54, about 3-seriate, marcescent, the lamina wedge-obovate, 6-nerved, 12 mm. long, 3.8 mm. wide; disk corollas sparsely hispidulous on tube and densely so on teeth below apex with short hairs with light base and dark tip, 6 mm. long (tube 2 to 2.5 mm., throat campanulate-funnelform, 2.5 mm. long, teeth ovate, 1.5 mm.); pales oblong, 6 mm. long, obtuse, glandular-ciliolate, toward apex setose with acuminate dark hairs with light bases; achenes (of ray) trigonous-obovoid, 2.5 mm. long, 1.8 mm. wide, blackish brown with whitish base, glabrous, somewhat shining.

Type in the U. S. National Herbarium, no. 1,069,158, collected on the southern slope of the Páramo de Quirorá, Mérida, Venezuela, altitude 2,950 meters, February 24, 1922, by Alfredo Jahn (no. 875).

Related to *Espeletia lindenii* Schultz Bip., but distinguished by the lack of tomentum on the stem and the under leaf surface. In Standley's revision of the genus *Espeletia* mention was made⁶ of the fact that *E. lindenii* was the only Venezuelan species of the genus not represented in Jahn's collections. In material received recently from Dr. Jahn it is represented by four numbers

⁶ Amer. Journ. Bot. 2: 483. 1915.

(727, 728, 872, 874) from the Páramo de Quirorá, at altitudes of 3,000 to 3,200 meters.

Dr. Jahn states that *E. marcescens* grows in moist, rather shady situations among bushes of *Espeletia neriifolia*, *Myrsine*, *Osteomeles*, and other shrubs, and that it is not found higher up on the open dry parts of the Páramo de Quirorá.

***Espeletia occulta* Blake, sp. nov.**

Caudex stout, 2 cm. thick, simple and densely leafy below the inflorescence, densely lanate-pilose with brownish white hairs; petioles of the leaves below the inflorescence 3 cm. long, sheathing the stem, densely lanate-pilose outside and at apex inside; blades oval-oblong, about 25 cm. long, 8 to 9.5 cm. wide, obtuse, at base cuneate or rounded-cuneate, minutely denticulate on the very narrowly revolute margin, subcoriaceous, above deep brownish green, glabrous or quickly glabrate except sometimes on costa, somewhat resinous, beneath densely ochroleucous- or griseous-tomentose with close tomentum, densely and closely feather-veined, the chief veins about 90 pairs, straight, prominent beneath, impressed above, connected beneath by a fine obscure reticulation; flowering stems about 30 cm. high, branched, densely lanate-pilose with brownish hairs, several-leaved, the leaves opposite or alternate, similar to the basal leaves but much smaller, 15 cm. long or less; heads numerous, in a flattish cymose panicle equaled and essentially hidden by the larger leaves, 2.5 cm. wide in flower, subsessile or short-pediceled in close leafy-bracted clusters of about 3 to 5 at tips of peduncles; disk in young flower 7 mm. high, 1.5 cm. thick; involucre 2-seriate, obgraduate, 1 to 1.3 cm. high, the outer phyllaries about 5, ovate, acutish, densely lanate-pilose, with indurate base and loose herbaceous apex; rays about 25, 2-seriate, yellow (?), marcescent, the lamina elliptic, 7 mm. long, 2.8 mm. wide; disk corollas yellowish (?), 6 mm. long (tube 3 mm., throat 2 mm., teeth 1 mm.), the tube pilose with several-celled hairs, the teeth pilose with conspicuously club-shaped hairs with brown tips; pales oblong, obtuse, 6.5 mm. long, above densely pilose with brownish hairs and especially along margin pilose with slenderly clavate, brown-tipped hairs; achenes of ray (submature) trigonous-obovoid, glabrous, 2.8 mm. long.

Type in the U. S. National Herbarium, no. 1,069,153, collected on the Páramo de Quirorá, Mérida, Venezuela, altitude 3,000 meters, October 8, 1921, by Alfredo Jahn (no. 730).

A very distinct species, characterized by its large, oval-oblong, subcoriaceous leaves, which almost conceal the heads. It is somewhat similar in appearance to *Espeletia neriifolia* (H. B. K.) Schultz Bip., but has much larger heads and leaves, and is evidently of different habit.

***Hymenostephium meridense* Blake, sp. nov.**

Herbaceous, at least above, 60 cm. high and more, the base not seen; stem slender, branched, rather densely cinereous-strigillose above, glabrescent below; internodes 9.5 to 16.5 cm. long; leaves opposite except in the inflorescence; petioles slender, densely cinereous-strigillose, 5 to 20 mm. long; blades ovate, 2.5 to 7 cm. long, 1.2 to 3.5 cm. wide, acute, mucronulate, at base rounded, mucronulate-serrulate (teeth 2 to 4 mm. apart), firm-papery, above evenly and rather densely hispidulous-pllosulous with incurved cinereous hairs with glandular-subtuberculate bases, smooth or slightly rough to the touch, beneath densely cinereous-strigose, triplinerved essentially from base, the veins and veinlets impressed above, prominulous-reticulate beneath; heads about 2.5 cm. wide, in loose irregular panicles of 3 to 6 at tips of stem and branches, on densely cinereous-strigillose pedicels 1 to 5.5 cm. long, naked or with 1 or 2 very small subulate bracts; disk 6 to (maturity) 8 mm. high, 6 to (maturity)

11 mm. thick; involucre 2 or sub-3-seriate, graduate, 4.5 mm. high, densely cinereous-strigose, the phyllaries lance-ovate or lanceolate, narrowed to a callous-mucronulate tip, appressed or the extreme tip somewhat loose; rays 12, golden yellow, oval, neutral, the lamina about 9 mm. long, 4 mm. wide; disk flowers numerous, their corollas yellow, finely hispidulous chiefly above, 4.5 mm. long (tube 0.6 mm., throat cylindric, 3.2 mm., teeth ovate, 0.7 mm.); pales acute, firm-tipped, accumbent-hispidulous, blackish green dorsally, about 5.5 mm. long; ray achenes inane, hispidulous; disk achenes obovate-oblong, 2.8 mm. long, 1 mm. wide, strongly compressed, multistriatulate, glabrous, blackish brown, epappose.

Type in the U. S. National Herbarium, no. 1,069,161, collected on the Páramo de Timotes, Mérida, Venezuela, altitude 3,200 meters, January 21, 1922, by Alfredo Jahn (no. 845).

Nearest *Hymenostephium goebelii* (Klatt) Blake, also known only from the high páramos of Venezuela, which is distinguished by its much narrower leaves and regularly tricephalous cymes.

Otopappus australis Blake, sp. nov.

PLATE 45.

Shrub, evidently scandent; stem slender, rather sparsely strigillose; leaves opposite; petioles 4 to 6 mm. long, strigillose; blades elliptic-ovate or ovate, 6 to 10.5 cm. long, 2.5 to 6.2 cm. wide, acuminate and more or less falcate, at base rounded and often unequal, pergamentaceous, obscurely serrulate, above deep green, shining, evenly strigillose but smoothish to the touch, beneath duller green, strigillose along the venation, densely dotted with shining glands, strongly triplinerved and with an additional weaker nerve on each side near the margin, the primary veins impressed above, the secondaries obscure, the primaries and secondaries prominent beneath, loosely reticulate, the secondaries spreading nearly at right angles; peduncles axillary and terminal, strigillose, 1.3 to 3 cm. long, bearing about 7 heads; bracts spatulate, 7 to 15 mm. long; pedicels 3 to 10 mm. long; heads campanulate, 6 mm. high, about 7 mm. wide; disk 4 to 5 mm. wide; involucre 3-seriate, 2.5 to 3 mm. high; outer phyllaries ovate, with indurate body and strongly reflexed linear obtuse herbaceous tip, gland-dotted and sparsely strigillose, the tip 2 to 3.8 mm. long; middle phyllaries similar but with shorter herbaceous tip; inner phyllaries lance-elliptic, indurate throughout, obtuse or acute, obscurely ciliolate, sparsely strigillose, gland-dotted; rays about 10, pale yellow, shorter than the disk, fertile, the tube 0.5 mm. long, the lamina linear, 3-nerved, 3 mm. long, 0.6 mm. wide, sparsely hispidulous and glandular dorsally, the nectary at base of style prominent, 0.5 mm. long; disk corollas pale yellow, 3.8 mm. long, hispidulous toward apex, the tube scarcely distinguishable from the throat; pales acuminate, hispidulous above, slender, 5 mm. long; ray achenes (immature) trigonous, narrowly 3-winged, 1.8 mm. long, the wings lacerate-ciliate, adnate to the base of the 3 awns, these 1.8 mm. long; disk achenes (immature) narrowly obovate, narrowly 2-winged, 2 mm. long, one of the wings lacerate-ciliate; awns 2 (sometimes 3), unequal, spinulose, 2.3 to 3 mm. long, adnate at base to the wings; squamellae united into a lacerate crown about 0.4 mm. long.

Type in the U. S. National Harbarium, no. 1,065,071, collected in valleys and hills of Patanemo, east of Puerto Cabello, Carabobo, Venezuela, altitude 10 to 250 meters, December 4 to 5, 1919, by H. Pittier (no. 8656).

ADDITIONAL SPECIMEN EXAMINED:

VENEZUELA: Trailing on bushes, Guaremales, November 20, 1920, Pittier. 9142.

This species, the first member of the genus to be found in South America, may be easily distinguished from its nearest relative, *O. verbesinoides* Benth. of Central America, by its very much smaller heads.

EXPLANATION OF PLATE 45.—*Otopappus australis*, from the type specimen. Natural size.

Oyedaea jahnii Blake, sp. nov.

PLATE 46.

Herbaceous above, doubtless shrubby below, erect-branched; stem stout, densely hispidulous or short-hirsute with incurved-ascending hairs with brownish tuberculate bases, glabrate below and densely maculate with the brownish persistent extreme bases of the hairs; leaves opposite; petioles stout, 5 to 10 mm. long, 2 to 4 mm. wide, marginate (especially in the upper leaves), densely strigose and accumbent-hirsute and ciliate; blades ovate or lance-ovate, or the uppermost lanceolate, 6.5 to 10.5 cm. long, 1.3 to 3.5 cm. wide, acuminate, cuneate or rounded-cuneate at base and decurrent on the petiole, serrulate (teeth about 8 to 10 pairs, 4 to 7 mm. apart), firmly pergamentaceous, above deep green, somewhat lucid, harshly and rather sparsely short-hispid with incurved hairs with persistent lepidote-tuberculate bases, along the chief veins densely hispid-pilose, beneath brownish green, evenly but rather sparsely hispidulous on surface with incurved subtuberculate-based hairs, along the larger veins densely hispidulous-pilosulous with several-celled subglandular brownish hairs and less densely hispid-pilose with antrorse eglandular hairs, triplinerved about 1 cm. above the base, prominulous-reticulate beneath; heads about 3.5 cm. wide, solitary at tips of branches on peduncles 3 to 4.5 cm. long and pubescent like the stem; disk 1 to 1.4 cm. high, 1.5 to 2.2 cm. thick; involucre 3-seriate, subequal or obgraduate, 11 to 12 mm. high, the 2 outermost series of phyllaries subequal, oblong-lanceolate, acute or subacuminate, erect or somewhat loose, with blackish green, indurate, usually subglabrous base (4 mm. long or less, 3 to 3.5 mm. wide) and much longer herbaceous tip, rather sparsely hispid-pilose and sordidly pilosulous with several-celled subglandular hairs, densely hispid-pilose-ciliate; innermost series of phyllaries usually shorter, oblong, the base subglabrous, indurate, the tip much shorter, usually deltoid, acute, densely hispidulous and sordid-pilosulous, hispid-pilose-ciliate, subherbaceous; rays about 10, golden yellow, oval, about 17 mm. long, 6.5 mm. wide, bearing an abortive undivided style; disk corollas yellow, glabrous except for the hispidulous teeth, 7.2 mm. long (tube 2.5 mm., throat slender-funnelform, 4 mm., teeth deltoid-ovate, 0.7 mm.); pales narrow, carinate, acute, 8.5 mm. long, glabrous on the sides, hirsute-pilose on keel, spinulose-ciliolate, toward apex densely pilosulous-ciliate with several-celled hairs; achenes (very immature) glabrous laterally, hispid-pilose-ciliate on margins; pappus of 4 or 5 (sometimes only 2?) slender unequal hispidulous fragile awns 4.5 mm. long or less, and a corona of about 12 unequal lacerate squamellae, connate below, 1 mm. long or less.

Type in the U. S. National Herbarium, no. 1,069,163, collected on the Páramo de Canaguá, Mérida, Venezuela, altitude 2,400 meters, January 21, 1922, by Alfredo Jahn (no. 911).

This species is nearest the Colombian *Oyedaea reticulata* Blake, but is distinct in its longer involucre of narrower phyllaries with much longer herbaceous tips, and its solitary heads. From *O. verbesinoides* DC., which it somewhat approaches in character of involucre, it is readily distinguished by its solitary heads and smaller leaves, which are sparsely and much more harshly pubescent beneath and not at all canescent. *Oyedaea jahnii* is the first species of the genus in which abortive styles have been found in the ray flowers. In its usually if not always 4 or 5-aristate pappus it is approached only by

O. verbesinoides, which sometimes has a pair of shorter awns in addition to the two which are normal for the genus.

EXPLANATION OF PLATE 46.—*Oyedaea jahnii*, from the type specimen. Natural size.

***Verbesina laevifolia* Blake, sp. nov.**

PLATE 47.

Shrubby; stem stout, glabrous, purplish-tinged; leaves alternate, crowded toward apex of stem (or branches); petioles stout, purplish, glabrous, 3 to 4 mm. long; blades wedge-obovate or elliptic-obovate, 6.5 to 11.5 cm. long, 2 to 3.8 cm. wide, rather abruptly short-acuminate, long-cuneate to base, obscurely crenate-serrulate chiefly above middle, somewhat wavy and slightly revolute on margin, glabrous and smooth to the touch on both sides, deep green above, somewhat paler green beneath, with purplish costa, feather-veined, the lateral veins about 13 pairs, anastomosing toward margin, impressed above, prominent beneath, the costa prominent beneath; panicle terminal, flattish, 8 to 13 cm. wide, surpassing the leaves, very many-headed, the branches purplish, densely spreading-pilose with several-celled whitish hairs, the bracts linear, 5 to 12 mm. long, about 1 mm. wide, the heads mostly sessile in glomerules of about 4, sometimes solitary on pedicels up to 6 mm. long; heads discoid, 8 to 10-flowered, 1 to (fruit) 1.2 cm. high, 5 to (fruit) 8 mm. thick; involucre 2-seriate, unequal, 4 to 5 mm. high, the phyllaries few, oblong, obtuse, rather sparsely pilosulous with erectish hairs especially toward margin, short-ciliate, with greenish white base and subequal, blackish green, appressed apex; disk corollas white, 6 mm. long, the tube and throat isodiametric, densely hispid-pilose with several-celled erectish hairs, the teeth linear-elliptic, papillose-ciliolate (tube 2.2 mm., throat 1.4 mm., teeth 2.4 mm.); pales obtuse or acutish, sometimes apiculate, about 7 mm. long, sparsely hispid-pilose on back, ciliolate above, blackish green toward apex; achenes obovate, compressed, 5 mm. long, 2.5 to 3 mm. wide, narrowly white-winged on both margins (wings about 0.5 mm. wide), short-pilose, ciliolate on the wings; awns 2, unequal, slender, 2.2 to 3.2 mm. long, adnate at base to the wings.

Type in the U. S. National Herbarium, no. 988436, collected on the Silla de Caracas, Coastal Range, Federal District, Venezuela, altitude 2,000 to 2,640 meters, December 26 to 29, 1918, by H. Pittier (no. 8332).

A member of the section *Lipactinia*, related to *V. guianensis* Baker and *V. schomburgkii* Schultz Bip., but distinguished by its smaller, perfectly glabrous and smooth leaves and glabrous stem.

EXPLANATION OF PLATE 47.—*Verbesina laevifolia*, from the type specimen. Natural size.

***Calea lindenii* (Schultz Bip.) Blake.**

Allocarpus lindenii Schultz Bip.; Wedd. Chlor. And. 1: 74, 1856.

Weddell's description, based on *Linden* 1625 of 1844, from the Sierra Nevada of Santa Marta, Province of Río Hacha, Colombia, altitude 4,050 meters, applies perfectly to specimens collected by Dr. Jahn (no. 70) at Pueblo Llano, Venezuela, altitude 2,150 meters, December 2, 1910. The species is a member of the small group of section *Allocarpus* centering around *Calea caracasana* (H. B. K.) Kuntze, and is readily distinguished from all its relatives by its perfectly glabrous stem.

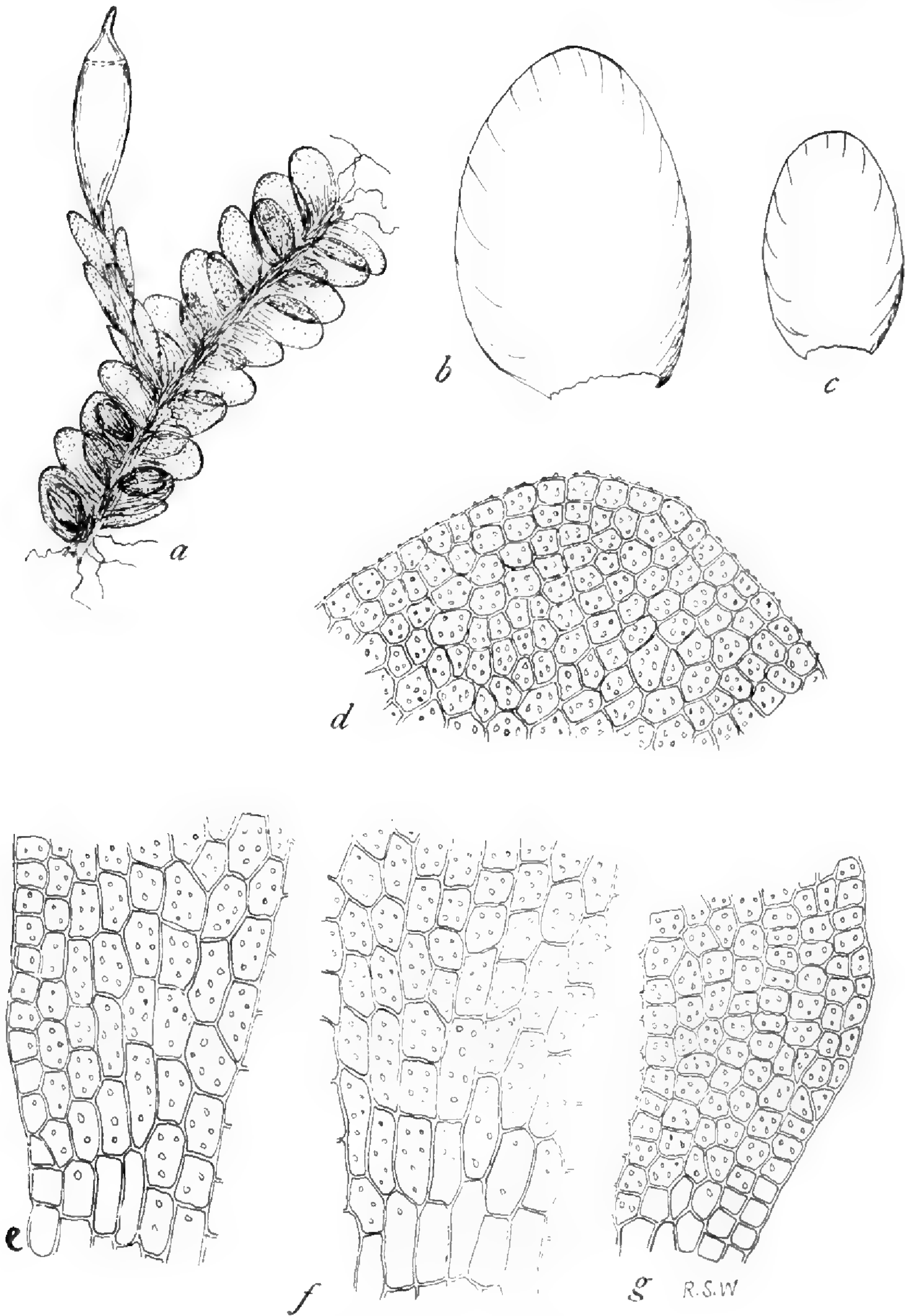
***Chaptalia meridensis* Blake, sp. nov.**

Scapöse perennial, 20 to 28 cm. high; root not seen; leaves all basal, 2 or more, marcescent; petioles 1 to 5 cm. long, stout, naked, densely rufous- or ochroleucous-lanate, becoming griseous; blades oval or suborbicular-oval, 5 to 6 cm. long, 3 to 4.5 cm. wide, broadly rounded and sometimes minutely apiculate, at base broadly rounded to subcordate, repand or subentire, coriaceous, above cinereously arachnoid-lanate, becoming glabrous and shining, beneath densely

lanate-tomentose with ochroleucous or griseous hairs, feather-veined, the lateral veins 7 to 9 pairs, impressed or prominulous above, prominulous beneath; scapes solitary, monocephalous, densely ochroleucous-lanate-tomentose, glabrescent, bearing scattered minute bracts similar to the outer phyllaries; head 2.5 cm. wide; disk turbinate, 1 to 1.2 cm. high, 1.2 to 1.6 cm. thick; involucre about 6-seriate, graduate, 1.1 to 1.3 cm. high, appressed, glabrous, the 3 outer series of phyllaries lance-linear or linear, acuminate, 4.5 mm. long or less, olive-green, 2-ribbed and with 2 central vittae, firm and somewhat rigid, the 2 innermost series broader and thinner, linear, acute or acuminate, with narrow subscarious margin, few-nerved above, the fourth series intermediate in length and characters; rays 2-seriate, bilabiate, pistillate, those of the outer series about 22, erect, apparently whitish, glabrous, the tube 2.5 mm. long, the outer lip narrowly elliptic, tridenticulate, 9 mm. long, 2 mm. wide, 4-nerved, the inner lip of 2 small erect teeth about 0.5 mm. long; those of the inner series few, similar but with shorter outer lip, this surpassing or slightly shorter than the style, 3.5 to 6 mm. long, tridentate with elongate central tooth or bidenticulate, in the latter case with a short supplementary third tooth to the inner lip; disk flowers hermaphrodite, their corollas glabrous, 7.5 mm. long, bilabiate, their lips erect, the outer tridenticulate, 3.5 mm. long, the inner equal, 2-parted to base into erect linear-lanceolate lobes; receptacle naked, glabrous, flattish; ray achenes (submature) fusiform, subrostrate, glabrous, not papillose, 5-nerved, 4.2 mm. long; disk achenes (immature) apparently similar; pappus of numerous, about 2-seriate, equal, slender, hispidulous, whitish or purplish-tinged setae 5 to 6.5 mm. long, irregularly and slightly connate at extreme base; anther tails subulate-acuminate, subentire, 1.2 mm. long; style branches (hermaphrodite flowers) very short, rounded, erect, minutely hispidulous, 0.4 mm. long.

Type in the U. S. National Herbarium, no. 1,069,625, collected on the Páramo del Molino, Mérida, Venezuela, altitude 2,200 meters, February 19, 1922, by Alfredo Jahn (no. 954).

Although this plant, which is very similar to species of *Trichocline* in appearance, is certainly referable to *Chaptalia* by virtue of its subrostrate achenes and the presence of reduced inner pistillate flowers, it departs from the definitions of that genus given by Bentham and Hooker and by O. Hoffmann in its bilabiate pistillate corollas. Several species having pistillate corollas with a short inner lip have been described, however, and among them the Peruvian *Chaptalia rotundifolia* D. Don seems to be the closest ally of *C. meridensis*. *C. cordata* Hieron., of Colombia and Peru, is also related to *C. meridensis*, but from description appears to differ decidedly in the narrower, cordate-ovate or cordate-elliptic leaves, only 2.5 to 2.8 cm. wide, the broader bracts of the scape (up to 2 mm. wide at base), the broader phyllaries, and the 3-nerved, bidentate ligules.



ERPODIUM LATIFOLIUM R. S. WILLIAMS



DRABA CHIONOPHILA BLAKE



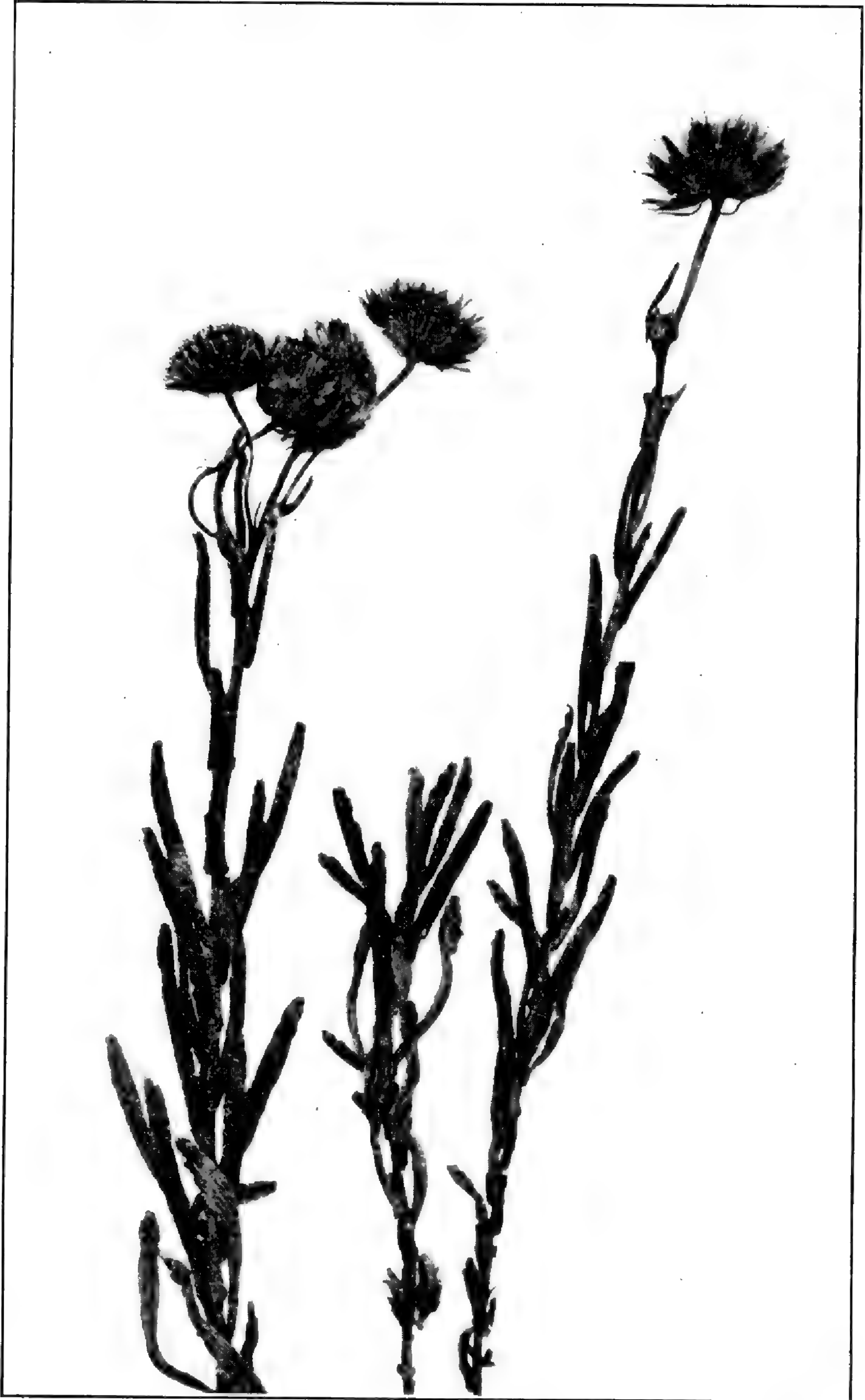
BAUHINIA CAUDIGERA BLAKE



FORSTERONIA ELACHISTA BLAKE



EVEA LUCENTIFOLIA BLAKE



PODOCOMA BARTSIAEFOLIA BLAKE



RIENCOURTIA OVATA BLAKE



OTOPAPPUS AUSTRALIS BLAKE



OYEDAEA JAHNII BLAKE



VERBESINA LAEVIFOLIA BLAKE

HEMIBACCHARIS, A NEW GENUS OF BACCHARIDINAE.

By S. F. BLAKE.

INTRODUCTION.

The genus *Baccharis* L. is one of the dozen largest genera of Asteraceae, containing some 250 to 300 species, all of which are confined to America. The genus is characterized by its functionally dioecious habit, the pistillate plants bearing heads composed entirely of pistillate fertile flowers with filiform corollas and an exserted style, while the staminate bear heads composed of hermaphrodite but sterile flowers with tubular 5-toothed corollas and entire or 2-branched styles. Several generic names, based chiefly on real or supposed distinctions in the number or form of the pappus bristles, were published for different species of the genus by some of the early authors, but all these are now universally referred to *Baccharis*, and the only other genera now recognized in the subtribe Baccharidinae are *Heterothalamus* Less. and *Parastrephia* Nutt.¹ The former has polygamo-dioecious heads, the staminate, of hermaphrodite but sterile flowers, sometimes provided with pistillate outer flowers with minutely or broadly ligulate corollas, the pistillate without admixture of hermaphrodite flowers and with the receptacle provided with pales which half include the flowers.

A group of some 15 species, occurring from Mexico to Costa Rica, has long afforded difficulty to botanists. These species, of which *Baccharis mucronata* H. B. K., *B. hirtella* DC., and *B. asperifolia* Benth. are the best known, are perplexingly intermediate between *Baccharis* and *Eschenbachia* (*Conyza* of most authors, not L.). They are herbs or shrubs with the general habit of *Baccharis*, but are polygamo-dioecious. The staminate plants are indistinguishable from *Baccharis*, but the pistillate bear heads containing 1 to 15 hermaphrodite but sterile central flowers with regular tubular corollas. On this account *Baccharis asperifolia* Benth. was referred by Ben-

¹ Since this paper was turned in for printing, further investigations in regard to Nuttall's genus *Parastrephia* have left little doubt that, as was suggested by O. Hoffmann in 1890, it was founded on abnormal specimens of a species of *Lepidophyllum* Cass., probably *L. phyllicaeforme* (Meyen) Hieron. This genus belongs to the Astereae-Solidagininae, and has no close affinity to *Baccharis*.

tham in the Genera Plantarum to *Conyza* (= *Eschenbachia*), where it has since been allowed to remain, while *B. hirtella* and *B. mucronata*, with the several similar species described in recent years, have been kept in *Baccharis*. This course is decidedly unsatisfactory, since it vitiates the characters of both *Baccharis* and *Eschenbachia*, and it seems best to distinguish a new genus to receive these species. This genus, which I propose to call *Hemibaccharis*, in allusion to the fact that the staminate plant is indistinguishable from *Baccharis*, will then be distinguished from *Baccharis* by the presence of hermaphrodite flowers in the center of the pistillate heads, perhaps also by its compressed 2-nerved achenes; from *Eschenbachia* by the presence of staminate plants; and from *Heterothalamus* by the absence of pales on the pistillate receptacle and the presence in the pistillate heads of central hermaphrodite flowers.

It may be noted that Cassini² ascribes subdioecious heads to the Jamaican *Baccharis scoparia* Swartz (type of the genus *Sergilus* Gaertn., retained provisionally by Cassini). He describes the inner flowers as male, with regular corolla, and the outer as similar in appearance, but actually female, with "corolla ambiguë," containing false stamens. Cassini's observations were apparently based on abnormal specimens, for those of this species which I have dissected are strictly dioecious. Staminate heads of *Hemibaccharis* sometimes show more or less abortive stamens in the outer florets, and the same condition is likely to occur in *Baccharis*, but the essential diagnostic feature of *Hemibaccharis* is the regular presence of hermaphrodite flowers in the center of the pistillate heads.

In *H. pringlei* only the staminate plant is known; in *H. salmeoides*, *H. androgyna*, and *H. corymbosa* only the pistillate. The corollas of both sexes are pubescent with short erect subclavate hairs. In several species the anthers of the hermaphrodite flowers in the center of the pistillate heads are more or less abortive.

The following key to the 15 species of the genus recognized is based chiefly on the material in the National Herbarium, supplemented by a number of sheets from the New York Botanical Garden and the Gray Herbarium, for the loan of which I am indebted to Dr. N. L. Britton and Dr. B. L. Robinson.

SYSTEMATIC TREATMENT.

***Hemibaccharis* Blake, gen. nov.**

Polygamo-dioecious herbs or shrubs, often scandent, with alternate leaves and small, whitish, discoid or disciform (in one species radiate), cymose-panicled heads; involucre 3 to 5-seriate, graduate, of linear to lanceolate or ovate, narrowly scarious-margined, green-centered phyllaries; receptacle flat-

²Dict. Sci. Nat. 37: 479, 1825.

tish, alveolate; pistillate heads heterogamous, the outer flowers (9 to 120) pistillate, fertile, their corollas with filiform tube, subtruncate or with very short, erect, often bidentate limb, much surpassed by the style, or in one species distinctly ligulate and exceeding the style, the central 1 to 15 flowers hermaphrodite but sterile, with regular tubular 5-toothed corolla and usually 2-branched style; staminate heads 8 to 70-flowered, with regular tubular 5-toothed corollas, in one species with 5 to 12 outer tubular-filiform pistillate flowers; stamens subentire or minutely sagittate at base, with rather long elliptic terminal appendages; style branches in the hermaphrodite flowers oblong to lanceolate, acute to acuminate, hispidulous, or the style rarely undivided, in the pistillate flowers linear, glabrous; fertile achenes compressed, rarely trigonous, 2 (rarely 3)-nerved, hispidulous; pistillate pappus setose, 1-seriate, the bristles capillary; staminate pappus with the bristles often dilated at apex.

Species 15, ranging from Chihuahua to Costa Rica. Type species, *Hemibaccharis hieracioides* Blake (*Baccharis hieraciifolia* Hemsl.).

KEY TO SPECIES.

Lamina of the pistillate corollas wanting or less than 1 mm. long and erect.

Leaves (at least the middle and upper) narrowed to an amplexicaul base.

Stem densely pubescent with spreading gland-tipped hairs.

Leaf blades lanceolate to elliptic or elliptic-lanceolate, gradually narrowed to base..... 1. *H. glandulosa*.

Leaf blades oval, rather abruptly contracted into a petioliform base.

2. *H. oaxacana*.

Stem pubescent with eglandular hairs. Leaves broadly ovate.

3. *H. pringlei*.

Leaves petiolate, not amplexicaul.

Heads larger, the pistillate 7 to 10 mm. high, the staminate 6 to 11 mm. high.

Stem densely pubescent with spreading gland-tipped hairs.

4. *H. hieracioides*.

Stem sparsely hispidulous with incurved eglandular hairs.

5. *H. simplex*.

Heads smaller, 2 to 6 mm. high.

Plants scandent or subscandent, frutescent; branches usually conspicuously zigzag; heads in usually small, rounded, cymose panicles terminating the branches and the numerous wide-spreading branchlets.

Leaves firmly papery or pergamentaceous, essentially glabrous except on the veins, the veinlets prominulous-reticulate on both sides.

6. *H. salmeoides*.

Leaves membranaceous or papery, usually pubescent on the surface beneath as well as on the veins, scarcely or not prominulous-reticulate.

Heads tiny, 2 to 3.5 mm. high; leaves chiefly ovate or elliptic.

7. *H. hirtella*.

Heads larger, 4 to 6 mm. high.

Leaves chiefly elliptic or lance-elliptic, less than half as wide as long; branches densely spreading-pilose with many-celled sordid hairs..... 8. *H. flexilis*.

Leaves chiefly oval or oval-ovate, more than half as wide as long; branches sordid-puberulous, glabrescent..... 9. *H. torquis*.

Plants erect, not scandent, herbaceous or frutescent; branches straight; heads in large terminal panicles.

Stem densely puberulous, hirtellous, or sordid-pubescent, sometimes tomentose.

Pubescence cinereous or griseous; heads 3 to 4 mm. high.

Pubescence of stem and upper leaf surface harsh; leaves not densely tomentose beneath----- 10. *H. mucronata*.

Pubescence usually soft; under leaf surface and often the stem densely tomentose----- 10a. *H. mucronata paniculata*.

Pubescence sordid, subglandular; heads 4.5 to 5 mm. high.

11. *H. irazuensis*.

Stem glabrous or essentially so, at least below, and often glaucescent, rarely thinly arachnoid.

Leaves oval or ovate-oval, the larger 3 to 6 cm. wide.

12. *H. sescenticeps*.

Leaves narrowly lanceolate to elliptic or oblong, the larger 1 to 3.5 cm. wide.

Leaves narrowly lanceolate, glabrous----- 13. *H. androgyna*.

Leaves chiefly elliptic, pubescent, at least on the veins beneath.

14. *H. asperifolia*.

Lamina of the pistillate corollas 2.5 mm. long, spreading-- 15. *H. corymbosa*.

1. *Hemibaccharis glandulosa* (Greenm.) Blake.

Baccharis glandulosa Greenm. Proc. Amer. Acad. 40: 36. 1904.

TYPE LOCALITY: Serranía de Ajusco, Federal District, Mexico.

SPECIMENS EXAMINED:

PUEBLA: Boca del Monte. 1907, *Purpus* 2792 (G, N).

STATE OF MEXICO: Desierto Viejo, Valley of Mexico, 1865, *Bourgeau* 1230 in part (N). Sierra de las Cruces, altitude 3,050 meters, 1899, *Pringle* 7709 in part (N).

FEDERAL DISTRICT: Serranía de Ajusco, altitude 2,895 meters, December 7, 1903, *Pringle* 8782 (type collection; N).

This herbaceous species is characterized by its densely glandular-pubescent stem, and lanceolate to elliptic leaves gradually narrowed into an amplexicaul base. The pistillate heads contain about "100 to 120" pistillate flowers, and 1 to "15" hermaphrodite. *Pringle* 7709, as represented in the National Herbarium, consists of two specimens, one with the amplexicaul leaf bases of this species, the other referable to *H. hieracioides*. *Bourgeau* 1230, in the National Herbarium, is *H. glandulosa*; the specimen of this number in the Gray Herbarium, however, is *H. hieracioides*. The two species may perhaps be identical, but are best kept distinct until further evidence is available.

2. *Hemibaccharis oaxacana* (Greenm.) Blake.

Baccharis oaxacana Greenm. Proc. Amer. Acad. 40: 37. 1904.

TYPE LOCALITY: Sierra de San Felipe, Oaxaca.

SPECIMENS EXAMINED:

OAXACA: Sierra de San Felipe, altitude 2,895 meters, December 13, 1895, *Pringle* 6257 (type collection; G, N); August 3, 1894, *Pringle* 5669 (G).

Related to *H. glandulosa*, but distinguished by its broader leaves, rather abruptly contracted into a margined amplexicaul base. In this species the staminate heads bear "5" to 12 filiform pistillate marginal flowers.

3. *Hemibaccharis pringlei* (Greenm.) Blake.

PLATE 48.

Baccharis pringlei Greenm. Proc. Amer. Acad. 41: 259. 1905.

TYPE LOCALITY: Sierra de San Felipe, Oaxaca.

SPECIMENS EXAMINED:

OAXACA: Wet ravines, Sierra de San Felipe, altitude 2,285 meters, December 11, 1895, *Pringle* 7014 (type; G, photo. N).

Although only the staminate form is known, the relationship of this species to the *H. glandulosa* group is so close that its inclusion in *Hemibaccharis* is justifiable. *H. pringlei* is nearest *H. oaxacana*, from which it differs in its larger leaves, up to 12 cm. long and 5.5 cm. wide, with the petioliform lower portion 1.5 cm. wide, and its numerous smaller heads (the staminate about 25-flowered, 5 to 6 mm. high), as well as in its eglandular pubescence.

EXPLANATION OF PLATE 48.—*Hemibaccharis pringlei*, from the type specimen in the Gray Herbarium. Natural size.

4. *Hemibaccharis hieracioides* Blake, nom. nov.*Baccharis hieraciifolia* Hemsl. Biol. Centr. Amer. Bot. 2: 129. 1881. Not *B. hieracifolia* Lam. 1783.

Herbaceous, the base not seen; stem branched above, densely spreading-pubescent with several-celled gland-tipped hairs; petioles naked below, 3 to 12 mm. long; leaf blades lanceolate or elliptic to lance-ovate, 4 to 12 cm. long, 1.3 to 2.5 cm. wide, acuminate, cuneate to acuminate at base, remotely spreading-mucronulate on margin, membranaceous, pubescent on both sides with several-celled, often gland-tipped hairs; heads rather numerous, in a loose panicle, the pedicels mostly 1 to 3 cm. long; pistillate heads 7 to 10 mm. high, with about 54 pistillate flowers and 3 or 4 hermaphrodite; staminate heads 9 to 11 mm. high, about 54-flowered; involucre about 4-seriate, 5 to 7 mm. high, the phyllaries linear-lanceolate, acuminate, densely stipitate-glandular, loose at tip, with green or purplish-tinged midline and apex and narrow scarious margins; achenes 2-nerved, compressed, hispidulous, 2 mm. long, their pappus whitish, 5 mm. long; style branches in the hermaphrodite flowers linear-lanceolate, acuminate, hispidulous.

TYPE LOCALITY: Desierto Viejo, Valley of Mexico.

SPECIMENS EXAMINED:

STATE OF MEXICO: Desierto Viejo, 1865, *Bourgeau* 1230 in part (G). Sierra de las Cruces, 1892, *Pringle* 5312 (G); in 1899, *Pringle* 7709 in part (N). Along brook, in shady woods, and on rocks, Mount Ixtaccihuatl, altitude 2,440 to 3,355 meters, 1903, *Purpus* 36 (N), 204 (G), 251 (N); in 1905, *Purpus* 1498 (N).

Hemsley's description of *Baccharis hieraciifolia* was based on *Bourgeau* 951 and 1230. The former has not been available for examination; the latter, as represented in the National Herbarium, is *H. glandulosa*, but the specimen in the Gray Herbarium is the present species. Hemsley's description of the leaves as "utrinque attenuata" indicates the plant here renamed *Hemibaccharis hieracioides*.

5. *Hemibaccharis simplex* Blake, sp. nov.

PLATE 49.

Herbaceous perennial, about 60 cm. high, the apparently solitary stems erect or ascending from a procumbent rooting base, slender, purplish-tinged, rather sparsely hispidulous with incurved sordid hairs with subtuberculate bases, glabrate below, simple below the inflorescence; internodes 5 to 25 mm. long; petioles 2 to 5 mm. long, naked; leaf blades cuneate-oblongate to elliptic-obovate, 3.5 to 7 cm. long, 1.3 to 2.2 cm. wide, acute, mucronulate, cuneate at base, remotely denticulate-mucronulate, membranaceous, above

green, glabrous except for the puberulent costa, hispidulous on margin, beneath paler green, sparsely and obscurely puberulous along the veins with subglandular hairs, penninerved, the veins and veinlets usually impressed above, somewhat prominulous-reticulate beneath; heads in both sexes rather few (about 15) in a terminal corymbiform panicle about 6 cm. wide, the pedicels 1 to 1.8 cm. long, puberulous with erectish several-celled hairs; pistillate heads 7 to 8 mm. high, 5 to 8 mm. thick, the pistillate flowers about 48, the hermaphrodite 2; staminate heads 6 mm. high, 5 mm. thick, about 32-flowered; involucre 4 to 5-seriate, graduate, 4.5 to 5.5 mm. high, the phyllaries linear-lanceolate, acuminate, green-centered, narrowly scarious-margined, ciliolate with subglandular hairs, otherwise essentially glabrous, subappressed; achenes (immature) compressed, subglabrous, the pappus 5 mm. long; style branches (hermaphrodite flowers) oblong-lanceolate, subacuminate, hispidulous.

Type in the U. S. National Herbarium, no. 462582, collected in woodlands, at Honey Station, Hidalgo, Mexico, November 25, 1903, by C. G. Pringle (no. 11821). Duplicate in the Gray Herbarium.

In this species, readily distinguished from *H. hieracioides* by its sparse incurved eglandular hairs, the main leaves often bear in their axils very short branchlets with two to several reduced leaves 8 to 20 mm. long.

EXPLANATION OF PLATE 49.—*Hemibaccharis simplex*, from the type specimen. Natural size.

6. *Hemibaccharis salmeoides* Blake, sp. nov.

PLATE 50.

Shrubby climber, the stout, subterete, grayish-barked stem 5 mm. thick, the branches more or less zigzag, about 30 cm. long, sordid-hirtellous with incurved brownish hairs, glabrate; internodes of branches 1.5 to 2.5 cm. long, of main stem up to 12 cm.; petioles incurved-hirtellous, naked, 6 to 13 mm. long; leaf blades oval or ovate-oval, 5.5 to 9 cm. long, 3 to 4.5 cm. wide, short-acuminate, mucronate, at base rounded-cuneate and often unequal, remotely mucronate-denticulate, firmly papery or pergamentaceous, above deep green, somewhat shining, hirtellous along costa, very sparsely so on surface or subglabrous, beneath deep dull green, obscurely hirtellous along costa and sometimes along the 4 or 5 pairs of lateral veins, these curved-anastomosing, like the secondaries and finer veinlets prominulous-reticulate especially beneath; pistillate panicles axillary and terminal, rounded, 6 to 38-headed, 1.5 to 4.5 cm. wide, the sordid-hirtellous pedicels 2 to 3 mm. long; pistillate heads 5 to 6 mm. high, the pistillate flowers 9, the hermaphrodite 1; involucre 3.5 mm. high, about 5-seriate, graduate, the phyllaries ovate (outer) to oblong or ovate-oblong, obtuse, appressed, lacerate-ciliate with sometimes gland-tipped hairs, glabrous dorsally, with dark green center and pale scarious margin; achenes compressed, 1.8 mm. long, 2-nerved, hispidulous; pappus rufidulous, 3.5 mm. long, the bristles slightly dilated above in the pistillate flowers, strongly so in the hermaphrodite; style branches (hermaphrodite flower) rhombic-oblong, acute, hispidulous.

Type in the U. S. National Herbarium, no. 860862, collected at Cobán, Alta Verapaz, Guatemala, altitude 1,250 meters, February, 1907, by H. von Türckheim (no. II. 1641). Duplicate in the Gray Herbarium. Also collected by von Türckheim (no. II. 1657) at the same locality, March, 1907 (G).

A strongly marked species, with much the habit of *Salmea scandens* (L.) DC. Both collections were distributed as *Baccharis hirtella* DC. Heyde & Lux 3389 (G, N), from Nebaj, Quiché, Guatemala, may be the staminate plant of this species.

EXPLANATION OF PLATE 50.—*Hemibaccharis salmeoides*, from the type specimen. Natural size.

7. *Hemibaccharis hirtella* (DC.) Blake.

Baccharis scandens Less. in Schlecht. & Cham. Linnaea 5: 146. 1830. Not *B. scandens* (Ruiz & Pav.) Pers. 1807.

Baccharis hirtella DC. Prodr. 5: 418. 1836.

Baccharis schiedeana Benth. in Oerst. Naturh. For. Kjöbenhavn Vid. Medd. 1852: 83. 1852.

Baccharis thomasi Klatt, Abh. Naturf. Ges. Halle 15: 326. 1882.

TYPE LOCALITY: Mexico. Type collected by Haenke.

SPECIMENS EXAMINED:

TEPIC: In 1892, *Palmer* 1846 (N).

VERACRUZ: Near Jalapa, *Schiede* 318 (fragm. of type of *B. scandens*; G); *Pringle* 6108 (N).

STATE OF MEXICO: *Bourgeau* 955 (N); *Purpus* 18 (N), 1499 (N).

FEDERAL DISTRICT: *Pringle* 11483 (N).

MORELOS: *Pringle* 9853 (N).

GUERRERO: *Nelson* 2237 (N), 2238 (N).

OAXACA: *Pringle* 4988 (N); *C. L. Smith* 259 (N); *Nelson* 1471 (N), 2236 (N).

MEXICO (without definite locality): *Ehrenberg* 1408 (N).

This common species is well distinguished by its scandent habit and usually strongly zigzag branches, its elliptic or ovate membranous leaves, and its tiny heads in usually small rounded cymes or panicles, terminating the branchlets. The attempts which have been made to distinguish *B. scandens* and *B. hirtella* are not supported by the specimens distributed under those names or by the original descriptions of the two supposed species. Fragments of the type of Lessing's *Baccharis scandens* have been examined in the Gray Herbarium. De Candolle's description is less clearly applicable, but probably refers to the same species, and the traditional use of this name has been followed. Bentham's *B. schiedeana* was a mere renaming of *B. scandens* Less. non Pers. *B. thomasi* Klatt, from description, seems referable to this species. It was described from material collected at Orizaba in 1866 by Thomas.

8. *Hemibaccharis flexilis* Blake, sp. nov.

Frutescent, scandent, the slender stem densely sordid-pilose with many-celled, crisped, spreading hairs, glabrescent below; internodes 3 to 11 cm. long; petioles naked, sordid-pilose, 2 to 5 mm. long; leaf blades elliptic, lance-elliptic, or ovate-elliptic, 3.5 to 7 cm. long, 1.3 to 3 cm. wide, acuminate, at base rounded or cuneate, remotely serrate to subentire, submembranaceous or papery, above deep green, puberulous along costa and sometimes along the veins, hispidulous on margin, beneath equally green, evenly but sparsely sordid-pilosulous on surface, densely so along veins, feather-veined or weakly triplinerved, the lateral veins about 4 pairs, impressed above, prominulous beneath, the secondaries in age somewhat prominulous; panicles small, numerous, axillary and terminal on the branchlets, about 2 to 3 cm. wide, densely sordid-pilosulous, the pedicels 2 to 5 mm. long; pistillate heads 5.5 to 6 mm. high, the pistillate flowers 16, the hermaphrodite 1 or 2; staminate heads 5 mm. high, 8-flowered; involucre 3.5 to 4 mm. high, about 5-seriate, graduate, the linear or (outer) linear-lanceolate phyllaries acute, green-centered with whitish margins, somewhat ciliolate, the outermost sordid-puberulous; hermaphrodite corollas with 5-parted limb, the style branches linear-oblong, obtuse or acutish; achenes compressed, hispidulous, 2 or 3-nerved, 1.3 mm. long, their pappus 1-seriate, brownish-tinged, 3.5 mm. long; bristles of hermaphrodite pappus obscurely dilated at apex.

Type (pistillate plant) in the U. S. National Herbarium, no. 860860, collected at Cobán, Alta Verapaz, Guatemala, altitude 1,350 meters, March, 1908,

by H. von Türckheim (no. II. 1636). Duplicate of this number in the Gray Herbarium, dated February, 1907.

Represented also in the National Herbarium by a staminate specimen from the same locality, altitude 1,400 meters, March, 1903, *von Türckheim* II. 728 (J. D. Smith, no. 8405). Distinguished from *H. hirtella* by its larger heads, and from *H. torquis* by its narrower leaves and longer pubescence.

9. *Hemibaccharis torquis* Blake, sp. nov.

PLATE 51.

Frutescent, scandent, the stem terete, grayish, glabrate, the branches strongly zigzag, sordidly puberulous or pilosulous, glabrescent; petioles 2 to 7 mm. long, essentially naked; leaf blades oval or ovate-oval, 3 to 8 cm. long, 1.8 to 5.5 cm. wide, acute or short-acuminate, rounded or cuneate-rounded at base, remotely mucronate-dentate or denticulate with very depressed teeth, submembranaceous, above deep green, evenly but not densely pilosulous or puberulous, glabrescent, smoothish, beneath duller green, sordid-pilosulous chiefly along the veins, feather-veined, the lateral veins 4 or 5 pairs; panicles rounded, about 5 cm. wide, axillary and terminal on the branchlets, the pedicels sordid-puberulous, 2 to 9 mm. long; pistillate heads 4 to 5 mm. high, the pistillate flowers about 30, the hermaphrodite 2; staminate heads 5 mm. high, 20 to 22-flowered; involucre about 5-seriate, graduate, 3.5 to 4 mm. high, the linear to (outer) linear-lanceolate phyllaries acute, with green midline and whitish margins, ciliolate, sparsely puberulous dorsally; hermaphrodite corollas with 5-parted limb, the style branches linear-oblong, acutish; achenes compressed, 2-nerved, hispidulous, 0.8 mm. long, their pappus 2.5 mm. long, brown-tinged; pappus of the hermaphrodite flowers slightly thickened toward apex.

Type in the U. S. National Herbarium, no. 471504, collected behind the "hospice des aliénés," San José, Costa Rica, November, 1892, by A. Tonduz (no. 1535, distr. Herb. Boiss.)

ADDITIONAL SPECIMENS EXAMINED:

VERACRUZ: Valley of Córdoba, 1865, *Bourgeau* 1637 (N).

OAXACA: Altitude 1,750 meters, 1900, *Conzatti & González* 44 (N).

GUATEMALA: Cobán, altitude 1,310 meters, 1887, *von Türckheim* 1350 (N).

COSTA RICA: San José, altitude 1,135 meters, 1893, *Tonduz* 1549 (N).

Related to *H. flexilis*, but distinguished by its much broader leaves and shorter pubescence. The type collection was distributed as *Stevia rhombifolia* H. B. K.

EXPLANATION OF PLATE 51.—*Hemibaccharis torquis*, from the type specimen. Natural size.

10. *Hemibaccharis mucronata* (H. B. K.) Blake.

Baccharis mucronata H. B. K. Nov. Gen. & Sp. 4: 60. 1820.

Pluchea floribunda Hemsl. Diagn. Pl. Nov. 2: 32. 1879.

TYPE LOCALITY: Between Santa Rosa and Los Ioares, Guanajuato.

SPECIMENS EXAMINED:

CHIHUAHUA: In 1885, *Palmer* 277 (N), 281 (N).

SAN LUIS POTOSÍ: *Parry & Palmer* 338 (N), 339 (N); *Schaffner* 359/783 (N); in 1902, *Palmer* 168 (N).

JALISCO: In 1886, *Palmer* 737 (N); *Pringle* 2364 (N); *Jouy* (N).

MICHOACÁN: *Arsène* 3241 (N), 3646 (N), 5296 (N).

STATE OF MEXICO: *Bourgeau* 969 (N); *Purpus* 1502 in part (N), 1579 (N).

FEDERAL DISTRICT (Mexico): *Bourgeau* 1096 (N); *Pringle* 11288 (N), 11482 (N).

TLAXCALA: *Arsène* (N).

PUEBLA: *Arsène* 2090 (N), 2267 (N), 5491 (N), 7206 (N).

GUERRERO: *Nelson* 2127 (N), 2262 (N).

A variable species, usually readily distinguished by the short harsh pubescence of the stems and upper leaf surfaces. The pistillate heads contain about 37 to 48 pistillate flowers, with the filiform corolla tube terminated by a minute erect ligule about 0.5 mm. long, much shorter than the style, and 3 or 4 hermaphrodite flowers; the staminate heads are about 28-flowered.

The name *mucronata* is here taken in its traditional sense, although the description is not particularly applicable.

10a. *Hemibaccharis mucronata paniculata* (Donn. Smith) Blake.

Diplostephium paniculatum Donn. Smith, Bot. Gaz. 23: 8. 1897.

TYPE LOCALITY: Between San Martín and Todos Santos, Huehuetenango, Guatemala.

SPECIMENS EXAMINED:

VERACRUZ: Orizaba, *Botteri* 496/821 (N).

STATE OF MEXICO: Salto de Agua, 1905, *Purpus* 1502 in part (N). Amecameca, 1899, *Deam* (G).

OAXACA: Sierra de Clavellinas, altitude 2,745 meters, 1894, *C. L. Smith* 260 (N).

CHIAPAS (?): Mountains around San Cristóbal Las Casas, *Ghiesbreght* 524 (G).

GUATEMALA: Between San Martín and Todos Santos, Huehuetenango, altitude 2,135 to 2,590 meters, December 25, 1895, *Nelson* 3629 (type; N). Casillas, 1892, *Heyde & Lux* 4251 (G). San Rafael, 1915, *Holway* 21 (G).

Although typical specimens of this more southern form, with their densely cinereous- or canescent-tomentose stems and under leaf surface, are very distinct in appearance from typical plants of the species, they show no technical distinctions, and seem to represent a subspecies only. Several of the collections cited above under *H. mucronata* approach this form more or less closely, particularly *Bourgeau* 969, *Purpus* 1579, *Nelson* 2262, *Pringle* 11482, and several of Arsène's specimens.

11. *Hemibaccharis irazuensis* Blake, sp. nov.

Herbaceous above, the base not seen; stem purplish, sparsely branched above, densely and sordidly short-pilose with several-celled matted hairs, glabrescent below; internodes 2 to 4 cm. long; petioles sordid-pilose, about 5 mm. long; leaf blades lance-ovate or lance-elliptic, 4 to 8 cm. long, 1.3 to 2.5 cm. wide, acuminate, cuneate at base, subremotely mucronate-denticulate, papery, above densely pilosulous with somewhat deciduous subtuberculate-based hairs, roughish at maturity, beneath brownish green, densely sordid-pilosulous along the veins and veinlets and sparsely so between them, feather-veined; panicles many-headed, rounded, 3.5 to 6 cm. wide, terminating the stem and the subterminal branches, the pedicels 2 to 6 mm. long, densely sordid-pilosulous; pistillate heads 4.5 to 5 mm. high, the pistillate flowers about 36, the hermaphrodite 4 or 5; staminate heads 5 mm. high, about 32-flowered; involucre about 5-seriate, graduate, 4.5 mm. high, the linear-lanceolate phyllaries acute to acuminate, green-centered, scarious-margined, ciliolate, the outer somewhat puberulous dorsally; teeth of the staminate corollas longer than throat, the style branches linear, acute, hispidulous; achenes compressed, hispidulous, 1.2 mm. long, the brown-tinged pappus 3.5 mm. long; pappus of hermaphrodite flowers scarcely dilated toward apex.

Type (pistillate plant) in the U. S. National Herbarium, no. 577970, collected at Laguna del Reventado, Volcán de Irazú, Costa Rica, altitude 2,300 meters, January 1, 1901, by H. Pittier (no. 14079). Duplicate (staminate plant) collected at the same time and place (no. 14078).

Distinguished from *H. mucronata* by its sordid subglandular pubescence, and slightly larger heads.

12. *Hemibaccharis sescenticeps* Blake, sp. nov.

Herbaceous above, the lower portion not seen; stem stoutish, branched above, glabrous and glaucescent or thinly arachnoid-tomentulose and glabrate; internodes 2.5 to 7 cm. long; petioles naked, glabrous or thinly tomentulose, 1 to 2.5 cm. long; leaf blades oval or oval-ovate, 6 to 13 cm. long, 3 to 6 cm. wide, short-acuminate, rounded to cuneate at base, mucronate-serrate, membranaceous to chartaceous, above along the veins sordid-puberulous, on the surface glabrous or tuberculate-hispidulous and glabrate, smooth or slightly rough, beneath somewhat paler green, sordid-puberulous along the chief veins, on surface very sparsely so or glabrous, feathervined, the lateral veins 5 to 7 pairs, prominulous beneath; heads very numerous at apex of stem and upper branches, forming large pyramidal panicles 10 to 21 cm. wide, the pedicels densely sordid-pilosulous, mostly 3 to 7 mm. long; pistillate heads 4 to 4.5 mm. high, the pistillate flowers about 27, the hermaphrodite 2; staminate heads 3.5 to 4 mm. high, about 22-flowered; involucre 3 to 4-seriate, somewhat graduate, 2.5 to 3.5 mm. high, the phyllaries linear or linear-lanceolate, acute to acuminate, with narrow green midline and scarious margins, somewhat ciliolate; teeth of the hermaphrodite corollas longer than the tube, the style branches linear-oblong, acute, hispidulous; achenes compressed, 2-nerved, hispidulous, the dull whitish pappus 3 mm. long; bristles of hermaphrodite pappus somewhat dilated above.

Type in the U. S. National Herbarium, no. 570333, collected in moist open woods and along creeks, Mount Ixtaccihuatl, State of Mexico, Mexico, altitude 2,135 to 2,440 meters, November, 1905, by C. A. Purpus (no. 1501).

ADDITIONAL SPECIMENS EXAMINED:

JALISCO: Between Mascota and San Sebastián, 1897, *Nelson* 4055 (N).

STATE OF MEXICO: Mount Ixtaccihuatl, 1903, *Purpus* 20 (N).

GUERRERO: Top of Sierra Madre near Chilpancingo, altitude 2,745 to 3,110 meters, 1894, *Nelson* 2203 (N), 2204 (N).

Distinguished by its glabrous or thinly arachnoid-tomentose stem and large leaves. In this as in some other species the outer flowers in the staminate head are often somewhat more slender than the central ones, and their stamens are more or less separate and aborted.

13. *Hemibaccharis androgyna* (T. S. Brandeg.) Blake.

Baccharis androgyna T. S. Brandeg. Univ. Calif. Publ. Bot. 6: 77. 1914.

TYPE LOCALITY: Cerro del Boquerón, Chiapas.

SPECIMEN EXAMINED:

CHIAPAS: Cerro del Boquerón, September, 1913, *Purpus* 6666 (type collection; N).

Distinct in its slender glabrous stem and narrowly lanceolate, falcate-attenuate, glabrous leaves. The scarcely mature pistillate heads are 3 to 3.5 mm. high, with about 22 pistillate flowers and 1 or 2 hermaphrodite. In the latter the anthers are reduced to vestiges on the throat, and the style is undivided and subtruncate. The staminate plant is unknown.

14. *Hemibaccharis asperifolia* (Benth.) Blake.

Baccharis asperifolia Benth. Pl. Hartw. 86. 1841.

Conyza asperifolia Benth. & Hook.; Hemsl. Biol. Centr. Amer. Bot. 2: 126. 1881.

Baccharis scabridula T. S. Brandeg. Univ. Calif. Publ. Bot. 6: 77. 1914.

TYPE LOCALITY: Mixco, Guatemala.

SPECIMENS EXAMINED:

STATE OF MEXICO: *Bilimek* 586³ (N); *Bourgeau* 1228 (N); *Purpus* 1500 (N).

OAXACA: *C. L. Smith* 262 (N); *Pringle* 6051 (N).

CHIAPAS: Cerro del Boquerón, August, 1913, *Purpus* 6665 (type collection of *B. scabridula*; N).

GUATEMALA: Mixco, 1840, *Hartweg* 589 (type collection of *B. asperifolia*; Y, photo. N). Cobán, *von Türckheim* 1354 (N), II. 1637 (N). Between San Martín and Todos Santos, *Nelson* 3617 (N).

NICARAGUA: San Rafael del Norte, *Miller & Griscom* 24 (N), 86 (N).

Distinguished by its large panicles of rather small heads (4 to 5 mm. high) and usually elliptic leaves, which are almost always scabrid above, and are more or less densely pubescent beneath. The pistillate heads contain 25 to 46 pistillate flowers and 2 to 4 hermaphrodite; the staminate heads are 20 to 27-flowered. The type collection of *Baccharis scabridula* consists of both staminate and pistillate plants, the latter with tiny submature heads with rufous pappus, but it does not appear specifically distinct from the other collections examined. A staminate specimen of the type collection of *Baccharis asperifolia*, from the herbarium of the New York Botanical Garden, has been available for examination through the kindness of Dr. N. L. Britton, confirming the identification of Bentham's species.

15. *Hemibaccharis corymbosa* (Donn. Smith) Blake.

Diplostephium corymbosum Donn. Smith, Bot. Gaz. 23: 8. 1897.

TYPE LOCALITY: Todos Santos, Guatemala.

SPECIMENS EXAMINED:

GUATEMALA: Todos Santos, Huehuetenango, altitude 3,050 meters, December 26, 1895, *Nelson* 3639 (type; N). Hacienda de Chancol, Huehuetenango, altitude 3,355 meters, January 2, 1896, *Nelson* 3644 (N).

This species differs from all others in the distinctly radiate heads, but may be included in the genus until more is known about it. The staminate plant has not yet been collected. In several heads dissected the pistillate (radiate) flowers varied from 34 to 39; the hermaphrodite were always 4. The tube of the ray flowers is 2 mm. long, and the lamina linear-elliptic, entire or bidenticulate, whitish, 2.5 mm. long, 0.3 to 0.4 mm. wide, exceeding the style branches. The achenes of the ray flowers are trigonous, 3-nerved, somewhat glandular and hispidulous, 0.8 to 1 mm. long, with a scanty, fragile, 1-seriate pappus. The achenes of the hermaphrodite flowers are 2 or 4-nerved, and apparently fertile.

DOUBTFUL SPECIES.

BACCHARIS ELEGANS SEEMANNII Schultz Bip. in Seem. Bot. Voy. Herald 303. 1856.

This variety, based on *Seemann* 2015, was described as "Var. β . *Seemannii*, Sz. Bip.; pubescens. Sierra Madre (n. 2015)," and the following note was added: "Obs. Ob flores centrales 1-2 capitulorum foemineorum hermaphroditos subgenus mihi est cum pluribus aliis speciebus e. g. *B. asperifolia*, Benth.! Pl. Hartweg. p. 86; *B. hirtella*, DC. Prod. vol. v. p. 418!" I have not seen the type, but all the specimens of *B. elegans* and its immediate allies examined have been without admixture of hermaphrodite flowers in the pistillate heads.

³ Hemsley (Biol. Centr. Amer. Bot. 2: 127. 1881) recorded this number and *Bates* 5 (not seen by me) as his 21st (unnamed) species of *Conyza*.

CONYZA THESIIFOLIA H. B. K. Nov. Gen. & Sp. 4: 75. 1820.

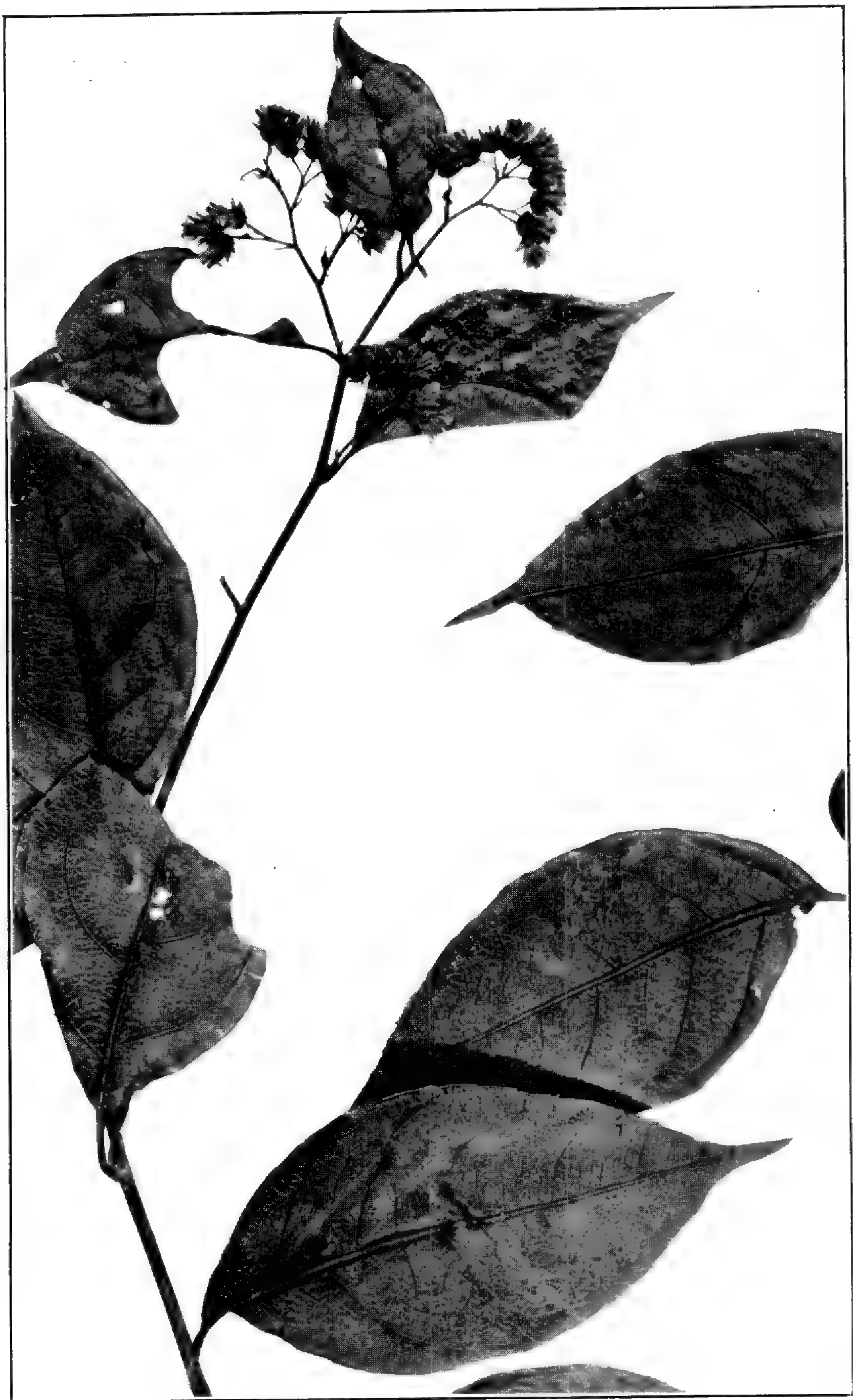
Said to be suffruticose, with glabrous stem, linear entire 1-nerved leaves about 3 cm. long and 1 mm. wide, and heads with central tubular hermaphrodite flowers and marginal filiform pistillate flowers. The locality is given as "in Regno Mexicano?". The species may belong to *Hemibaccharis*, or may really be a species of *Eschenbachia* (*Conyza*).



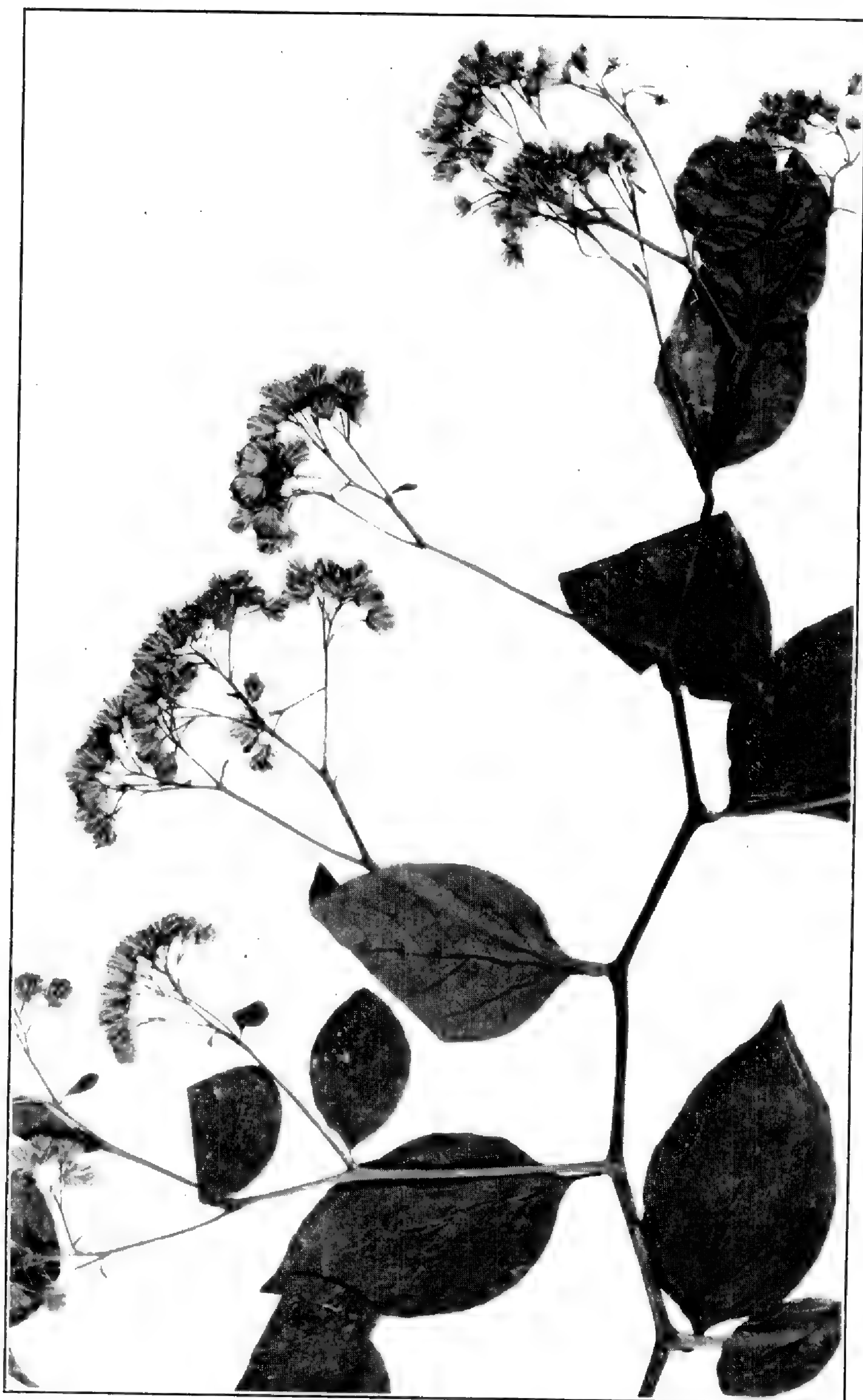
HEMIBACCHARIS PRINGLEI (GREENM.) BLAKE



HEMIBACCHARIS SIMPLEX BLAKE



HEMIBACCHARIS SALMEOIDES BLAKE



HEMIBACCHARIS TORQUIS BLAKE

THE AMERICAN SPECIES OF CANAVALIA AND WENDEROTHIA.

By C. V. PIPER.

INTRODUCTION.

In connection with economic investigations of certain species of *Canavalia*, the writer became impressed with the paucity of our botanical knowledge of the genus and the great confusion existing. As a result of these conditions, it seemed desirable to attempt to monograph the genus. In this effort he received the cordial aid of Col. Sir David Prain, until recently Director of the Royal Botanic Gardens at Kew, who requested Mr. S. T. Dunn to assist in the work. The Old World species, all of which belong to the section *Eucanavalia*, have been treated fully in a recently published paper (Kew Bull. Misc. Inf. 1922: 129-145. 1922). The task of elucidating the New World species was left to the writer. In connection with this work he desires to express his cordial thanks for the loan of herbarium material to the following gentlemen: Col. Sir David Prain, Royal Botanic Gardens, Kew; Dr. Hermann Ross, Staatsherbarium, Munich; Dr. B. L. Robinson, Gray Herbarium; Dr. J. M. Greenman, Missouri Botanical Garden; Dr. N. L. Britton, New York Botanical Garden; Dr. W. A. Setchell, University of California; Dr. C. F. Millspaugh, Field Museum of Natural History.

HISTORY OF THE GENERIC NAMES PROPOSED.

Some writers use *Canavali* as the generic name, but *Canavalia* is preferred by most. The latter has been included in the list of *nomina conservanda* of the International Code of Nomenclature. The data regarding the important proposals of the genus and its synonyms are given chronologically.

Canavali Adans. Fam. Pl. 2: 325, 531. 1763.

Adanson gives a brief description of the genus *Canavali* based on Hort. Mal. plates 43, 44, and 45, but an index, page 531, has "Katu tsjandi, Malab." and also "Dolichos, 3. Lin. sp. 725." Plate 43 of the Hortus Malabaricus is labeled Katu tjandi and also Canavali. It clearly represents *Canavalia turgida* Graham, but *Dolichos* 3 of Linnaeus is *D. ensiformis*, that is, *Canavalia ensiformis*.

Clementea Cav. Anal. Cienc. Nat. 7: 63. 1804.

Only species, *C. nitida* Cav., which probably is *Canavalia baha-mensis* Britton (*C. ekmani* Urban).

Canavalia DC. Prodr. 2: 403. 1824.

Under the generic name DeCandolle cites as synonyms *Canavali* Adans. and *Malocchia* Savi (Diss. 15. 1824 and 1. 1825). The first species described is *C. obtusifolia* (Lam.) DC., which is erroneously considered the same as Rheede's "Catu-Tsjandi" (Hort. Malabar. 8: 25, pl. 43), and correctly as Plukenet's Almag. Bot. pl. 51, f. 2.

Inasmuch as *Clementea* Cav. and *Malocchia* Savi have priority over *Canavalia* DC., one of these might be chosen as the legitimate name to use, but such a change would be unfortunate. The difficulty would be avoided by accepting the genus as beginning with Adanson and changing the spelling *Canavali* to *Canavalia*, as has been done with other similar barbarous names. Many recent authors have used the name *Canavali*, but its Latinized form is more desirable. In any event it would seem impossible to accept *Canavalia* if accrediting it wholly to DeCandolle, owing to the priority of *Clementea* and *Malocchia*.

Wenderothia Schlecht. Linnaea 12: 330. 1838.

One species, *W. discolor* Schlecht. The group of species allied to this is considered of generic value in the present monograph, being clearly separated by characters of calyx, corolla, and pod.

Cryptophasolus Kuntze, Rev. Gen. Pl. 1: 176. 1891.

One species, *C. anamensis* Kuntze, which probably is *Canavalia gladiata* (Jacq.) DC.

DISTRIBUTION.

The species of *Canavalia* occur in both hemispheres, mostly in the tropics, but a few reach the subtropics. One species, *C. maritima*, a variable seashore plant, occurs in both hemispheres; of the remainder 13 are Old World species and 24 New World species.

ECONOMIC USES.

The genus as a whole is of comparatively little economic importance. Some of the species are rather attractive, but not one is cultivated for ornament. *Canavalia gladiata*, the sword bean, is generally cultivated in the tropics and subtropics, and both the young pods and seeds are used to a small extent for food. The seeds are red, ochraceous, or white and the large beans rather ornamental. *Canavalia ensiformis*, the jack bean, also known as Overlook, Giant Pod, and Wataki bean, is more or less employed as a green manure crop. Boname (Agr. Prat. Pays Chauds 10: 370-378. 1910) speaks of it enthusiastically as a food plant, but in some cases at least it gives rise to intestinal discomforts. The attractive

white seeds contain more urease than any other known, and are employed as a commercial source of this substance. The jack bean has been more or less employed as feed for domestic animals, but both the herbage and the seeds are eaten with reluctance by most animals. *Canavalia maritima* is cosmopolitan in the tropics on sea-shores, where it serves as a sand binder. There is difference of opinion as to the edibility of the seeds. Ridley (Trans. Linn. Soc. Bot. 3: 293. 1888-9) says the seeds are eatable but rather mealy, but later (Journ. Straits Branch Roy. As. Soc. 71. 1900) writes "beans said to be poisonous." Trimen (Fl. Ceylon 2: 67. 1894) says "seeds are much eaten, boiled, at Batticaloa and elsewhere." As several closely related species of southern Asia have been confused with *C. maritima*, there is doubt as to the identity of the species referred to in the above notes. Banks and Solander (Bot. Cook's Voy. 1: 24) say it was eaten by members of the expedition but was very bad. This plant may have been *C. baueriana*, a very similar species. Of this last Maiden (Proc. Linn. Soc. N. S. W. 28: 702. 1903) narrates how sailors on Norfolk Island were made very ill by eating this bean; further (Agr. Gazette N. S. W. 10: 281. 1899) that "the seeds are eaten by the blacks after cooking, as they are poisonous in the raw state." It is not unlikely that the deleterious principles may be removed by boiling in several changes of water.

The seeds of *Canavalia virosa*, an Indian species, are generally reputed to be poisonous. Birdwood (Veg. Prod. Bombay ed. 2. 118. 1865) writes, "The pods are dried like French beans, boiled, and eaten, when intoxication follows."

Canavalia campylocarpa, the Babricou bean, is utilized as a green manure crop in Barbados.

POLLINATION.

No very special studies have been made in the pollination of *Canavalia*. In experiments at Biloxi, Mississippi, it was found that bagged flowers set pods and seeds in *C. ensiformis*. Apparently insect visits are not necessary. Under greenhouse conditions numerous species set pods readily, and presumably the flowers are not visited by insects, at least large ones like honeybees or bumblebees. The flowers are greatly inclined to drop if handled. This makes artificial crossings almost impossible. So far as known, none such have yet been made nor are any natural hybrids definitely known.

At the Hawaiian Sugar Planters' Experiment Station, Honolulu, Dr. H. L. Lyon has obtained numerous seed variants of *C. ensiformis*. These are speckled, banded, or marbled in various patterns and colors. It is still uncertain whether these variations are the result

of natural crossing or are caused by other factors—a matter that is being investigated by Dr. Lyon.

The mechanism of the flowers of *C. bonariensis* Lindl. is described and figured by Lindman (Bih. Svensk. Vet. Akad. Handl. 27: Afd. III. No. 14: 53. *fig. 17*. 1902). In southern Rio Grande do Sul, Brazil, the flowers are visited in December by very large bumblebees. The bee alights on the standard, usually about horizontal in its reflexed position, and inserts its beak into the slit of the erect keel, which it spreads apart. The tip of the keel is thereby depressed and the anthers and stigma extended.

SPECIFIC CHARACTERS.

In the section *Eucanavalia* distinct species resemble each other so closely that often they can not be separated except by the mature pods and seeds. Unfortunately pods and seeds are often absent from herbarium specimens, so that the identification of such specimens is unsatisfactory. The seed characters in particular appear to be constant and reliable. Much of the confusion in botanical literature is doubtless due to the lack of mature pods and seeds on the specimens.

SYSTEMATIC TREATMENT.

CANAVALLIA Adans.

DESCRIPTION OF THE GENUS.

Herbs or shrubs, mostly twining; leaves pinnately trifoliate; petioles sulcate above; petiolules somewhat fleshy; stipules caducous, thin, not striate; peduncles axillary; flowers numerous, in raceme-like thyrses, two or more short pedicels often arising from each prominent pedicellar gland; bracts minute, caducous; bracteoles mostly orbicular, caducous; calyx tubular-companulate, bilabiate, the upper lip large, bilobed, the lower small and simple or three-lobed; standard large, reflexed, with a pair of basal auricles and bearing two callosities toward the base; wings free, narrow, auricled; keel falcate, truncate, the petals partly united; stamens monadelphous, the vexillar one partly or rarely entirely free; anthers all alike; style glabrous, rarely a little hairy near the tip; stigma capitate; pods stipitate, oblong or linear, beaked, straight or curved, compressed or turgid, the inner layer often loose and papery, the valves strengthened by one, two, three, or four longitudinal ribs, all very close to the sutures; seeds several to many, globose or ellipsoid and compressed, the hilum linear.

Species about 40, all tropical or subtropical in both hemispheres.

KEY TO THE SECTIONS.

Pod valves each with one longitudinal ridge very near the ventral suture; leaves coriaceous; stems woody; seeds spherical or nearly so.

1. *Clementea* (*Clementea* Cav.).

Pod valves each with more than one longitudinal ridge; leaves membranaceous; seeds ellipsoid, mostly compressed.

Ridges two on each valve, one contiguous to each suture; stems woody.

2. *Diplegma*.

Ridges three, two near the ventral suture, one very close to the dorsal suture often united to the sutural edge; stems mostly herbaceous.

3. *Eucanavalia* (*Malocchia* Savi).

Ridges four, two near each suture; stems herbaceous-----4. *Didiplopleura*.

1. *Clementea*. Shrubby vines with coriaceous leaflets; calyx with upper lip bilobed and lower lip simple; keel blunt, not produced; pod valves each with but a single longitudinal rib, this close to the ventral suture; seeds subglobose.

Lower lip of calyx entire.

Leaflets prominently reticulate; corolla 1.5 cm. long; pods dark brown, the valves thick; seeds red, the (1 mm. wide) hilum two-fifths of the circumference. (Cuba)-----1. *C. cubensis*.

Leaflets not prominently reticulate; corolla 2.5 cm. long; pods pale, the valves not thick; seeds brown, the (2 mm. wide) hilum one-half the circumference. (Argentina, etc.)-----2. *C. bonariensis*.

Lower lip calyx obscurely 3-lobed.

Leaflets 7 to 10 cm. long; pods 12 to 15 cm. long, 4 cm. broad; seeds over 2 cm. long-----3. *C. rusiosperma*.

Leaflets 3 to 7 cm. long; pods 10 cm. long, 2.5 cm. wide; seeds 1.5 cm. long.-----4. *C. nitida*.

2. *Diplegma*. Stems woody; leaflets membranaceous or slightly coriaceous; upper lip of calyx emarginate; keel not produced, blunt; pod valves each with two longitudinal ribs, one close to each suture.

Corolla 2.5 cm. long; pods 25 cm. long, the ribs winglike----5. *C. macropleura*.

Corolla 1.5 cm. long; pods 12 cm. long, the ribs not winglike---6. *C. parviflora*.

3. *Eucanavalia*. Vines, mostly herbaceous; calyx with bilobed upper lip about as long as the tube, the lower lip trilobed; keel not produced, obtuse; pod valves each with three longitudinal ribs, one close to each suture, the third close to the ventral rib; inner layer of pod thin and papery, adherent in some species, separating in others; seeds compressed.

Leaflets 3-nerved -----I. VARIICOLORES.

Leaflets not 3-nerved.

Herbage canescent-puberulent-----II. PUBERULAE.

Herbage green, usually minutely strigillose-----III. GENUINAE.

I. VARIICOLORES. A single species-----7. *C. variicolor*.

II. PUBERULAE. A single species-----8. *C. puberula*.

III. GENUINAE. Eighteen species.

Plants of the seashore, usually prostrate or procumbent but climbing when in thickets. Leaflets suborbicular, thickish; hilum about one-fifth the circumference of the seed.

Leaflets obtuse or retuse, glabrous or nearly so-----9. *C. maritima*.

Leaflets acute, strigillose on both faces-----10. *C. apiculata*.

Plants not of the seashore, ascending or climbing.

Fruit 20 times as long as broad. Seeds white-----11. *C. ensiformis*.

Fruit 4 to 8 times as long as broad.

Pods short, strongly curved-----12. *C. campylocarpa*.

Pods nearly straight, elongate.

Seeds pink-buff; pods straw-colored-----13. *C. plagiosperma*.

Seeds ochraceous to brown, mostly unicolored; pods dark.

Pods only 4 times as long as broad; leaflets obtuse---14. *C. arenicola*.

Pods more than 4 times as long as broad; leaflets not obtuse (except in *C. amazonica*).

Hilum short, not over one-fifth the circumference of the seed.

Apex of leaflets not strongly acuminate.

Leaflets firm, almost chartaceous. Intermediate ridge 2 to 3 mm. from the ventral ridge-----15. *C. mexicana*.

Leaflets membranaceous.

Intermediate ridge 3 to 4 mm. from the ventral ridge; pods 12 to 14 cm. long-----16. *C. panamensis*.

Intermediate ridge 5 mm. from the ventral ridge; pods 17 cm. long-----17. *C. paraguayensis*.

Apex of leaflets strongly acuminate.

Leaflets conspicuously venulose-----18. *C. fendleri*.

Leaflets not conspicuously venulose-----19. *C. leptophylla*.

Hilum long, at least one-third the circumference, and nearly as long as the seed.

Pods 20 to 30 cm. long; seeds red, white, or cinnamon-colored.

20. *C. gladiata*.

Pods less than 20 cm. long; seeds brownish.

Intermediate rib of pod 2 to 3 mm. from the ventral rib.

Leaflets acutely acuminate and apiculate, conspicuously reticulate-----21. *C. caribaea*.

Leaflets obtusely acuminate and apiculate, not conspicuously reticulate-----22. *C. boliviana*.

Intermediate rib of pod 5 mm. from ventral rib.

Leaflets obtuse or obtusish, elliptic in outline.

23. *C. amazonica*.

Leaflets not obtuse or obtusish.

Seeds black and brown striped; leaflets lance-oblong, acute, reticulate; calyx teeth ciliate-----24. *C. dictyota*.

Seeds isabella-color; leaflets ovate, acuminate; calyx teeth not ciliate-----25. *C. brasiliensis*.

4. *Didiplopleura*. Stems herbaceous; leaflets membranous; calyx with upper lip broad, emarginate, and lower lip small, 3-lobed; pod valves each with 4 longitudinal ridges, a pair of them close to each suture.

A single species-----26. *C. anomala*.

1. *Canavalia cubensis* Griseb. Mem. Amer. Acad. n. ser. 8: 178. 1861.

Stems climbing, woody, glabrous; petioles slender, mostly shorter than the leaflets; stipules and stipels not seen; petiolules puberulent, 3 mm. long; leaflets coriaceous, oblong to broadly oval, shortly and obtusely acuminate, rounded at base, glabrous, prominently reticulate, 5 to 8 cm. long; peduncles about as long as the 10 to 15-flowered thyse, the rachis sparsely puberulent; pedicellar glands prominent; pedicels 3 to 4 mm. long; bracteoles minute, orbicular; calyx campanulate, glabrous, 10 mm. long, the broad upper lip bilobed, about equaling the tube, the lower lip entire, oblong, 2 mm. long; corolla purple, 1.5 cm. long; standard broadly obovate, reflexed, not emarginate, obscurely biauriculate and with two linear callosities; wings nearly as long as the keel; keel falcate, obtuse; stigma capitate; young pods sparsely strigillose; mature pods oblong, beaked at tip, stipitate, compressed, dark brown, the valves thick and much wrinkled, each with a single rib near the ventral suture, 2 to 9-seeded, 10 to 15 cm. long; seeds dark red, shiny, 17×17×10 mm., the linear blackish hilum two-fifths of the circumference.

CUBA: Monte Verde, a coffee plantation in the mountains back of Santa Catalina de Guantánamo, *Wright* 139, "climbing over trees" (Gray, Kew).

2. *Canavalia bonariensis* Lindl. Bot. Reg. 6: pl. 1199. 1828.*Canavalia paranensis* Hook. & Arn. Bot. Misc. Hook. 3: 200. 1833.*Canavalia monodon* E. Mey. Comm. Pl. Afr. Austr. 149. 1835.*Canavalia cryptodon* Meisn. Lond. Journ. Bot. 2: 96. 1843.

Stems woody, climbing, terete, sparsely retrorse-puberulent when young, glabrate in age; petioles slender, glabrous, about as long as the leaflets; stipules narrowly ovate, attenuate-acuminate, 2 mm. long, each with a thickened gland at base; stipels very minute, aculeolate; petiolules 3 mm. long, densely strigillose; leaflets coriaceous, narrowly oval to broadly lanceolate, short-acuminate, the tip obtuse and apiculate, rounded to obtusely angled at base, finely reticulate, sparsely strigillose on both sides when young, becoming glabrous, 4 to 7 cm. long; peduncles about as long as the 10 to 15-flowered thyrses; pedicellar glands prominent; bracteoles orbicular, minute; calyx coriaceous, campanulate, pale-margined, sparsely strigillose, 10 to 12 mm. long, the broad upper lip bilobed, shorter than the tube, the entire lower lip 2 mm. long, triangular, acute; corolla purple, 2.5 cm. long; standard reflexed, obovate, deeply emarginate, attenuate at base to a claw 6 mm. long, not auriculate, with a median groove on each side of which is a linear callosity; wings equaling the keel, falcate, obtuse, auriculate at base, the slender claw 7 mm. long; keel falcate, obtuse, the petals united from above the middle to the tip, 2.5 mm. long, the auricles long, curved, acute, the slender claw 7 mm. long; stamens monadelphous, the vexillar one partly free; style glabrous; stigma capitate; ovary pubescent, 7-ovuled; pods pale, oblong, straight, long-stipitate, beaked, the only one examined 7 cm. long, 2.5 cm. wide, 2-seeded, a single longitudinal rib 2 to 3 mm. from the ventral suture, the inner layer adherent; seed dark brown, 15×17×10 mm., the linear hilum about half the circumference of the seed.

Southern Brazil, Uruguay, and east-central Argentina; introduced in South Africa.

URUGUAY: Santa Lucía, *Gibert* 1084 (Kew).

BRAZIL: Rio de Janeiro, *Glaziov* 6179 (Kew). Without locality, *Sello* 1426 (Kew).

AFRICA: Port Natal, *Grant*; *Krauss* 296, type of *C. cryptodon* (Kew, N. Y., Mo.). Omtendo River, *Drège* (Kew, Mo.), type of *C. monodon*. Natal, *Gerrard* 644 (Kew).

Canavalia bonariensis was described originally from greenhouse plants raised from seeds from Buenos Aires. The type of *C. paranensis* was collected on the Río Paraná, Argentina (?), by Tweedie. It is reported by Benthams from the Piranga River, Minas Geraes, Brazil. Hicken (*Chloris Platensis Argentina* 136. 1910.) records the plant from Maciel and Isla Santiago, Argentina, and from Entre Ríos, Uruguay. Lindman (*Bih. Svensk. Vet. Akad. Handl.* 27: Afd. III. No. 14: 53. 1902) found it at Rio Grande do Sul, Brazil.

Canavalia monodon was based on plants from the Omtendo (? Umtentu) River, Natal, *Drège*, and *C. cryptodon* is based on *Krauss* 296 from Port Natal. With scarcely a doubt, *C. bonariensis* is an introduced plant in South Africa.

Arechavaleta (*Anal. Mus. Nac. Montevideo* 3: 384. 1901) describes the pods as 10 to 15 cm. long and containing 5 or more seeds.

3. *Canavalia rusiosperma* Urban, Symb. Antill. 1: 473. 1900.

Stems woody, climbing, terete, sparsely appressed-puberulent with reflexed hairs, at length glabrous, becoming as much as 10 cm. thick (*Cook & Collins*); stipules triangular, 1.5 mm. long, caducous; petiole usually much shorter than

the leaflets; petiolules puberulent, 4 to 5 mm. long; leaflets coriaceous, ovate-oblong, very shortly acuminate at apex, the tip blunt and not apiculate, rounded to subcordate at base, glabrous or nearly so, prominently reticulate-venose beneath, 7 to 10 cm. long, 4 to 5 cm. broad; peduncles short, the inflorescence about 20-flowered; pedicellar glands prominent; bracteoles suborbicular; calyx 10 to 14 mm. long, campanulate, glabrous or nearly so, 2-lipped, the upper lip as long or a little longer than the tube and divided to the base, its lobes rounded, the lower lip entire, lanceolate, concave, thickish, 1.5 to 2 mm. long; corolla purplish, 2 cm. long; standard with a broad claw 7 mm. long, the blade orbicular, deeply bilobed, the callosities lunate, thick, the auricles short, broad, and inflexed; wings 17 mm. long, linear-oblong, obtuse, curved, the claw 6 mm. long, the auricles curved and reflexed; keel as long as the wings, incurved, obtuse, the petals united for the upper fifth to the tip, the claws 6 mm. long, the auricles curved, reflexed; stamens monadelphous; style glabrous; stigma capitate, lop-sided; pods stipitate, the stipe 1.5 to 2 cm. long, the body linear-oblong, compressed, dark brown, much wrinkled, becoming brittle in age, 12 to 15 cm. long, 4 cm. broad, with a single longitudinal ridge 3 to 4 mm. from the ventral suture; seeds subglobose, shiny, dark red or rarely yellow, 18 to 24 mm. long, 15 to 20 mm. broad, 10 to 15 mm. thick; hilum linear, 23 mm. long about two-fifth of the circumference.

PORTO RICO: Maricao, *Sintensis* 452 (U. S.). Monte Montoso, *Britton & Pennell* 4151 (U. S.). Cuatro Calles, *Shafer* 2823 (U. S.). Lares to Callejones (*fide* Urban). Near Quebradillas (*fide* Urban).

DOMINICAN REPUBLIC: Near Puerto Plata in forests of Loma Isabel de la Torre, *Eggers* 2659, type (*fide* Urban). Constanza, *Türkheim* 3032 (*fide* Urban). San Pedro de Macorís, *Rose, Fitch & Russell* 4184 (U. S.). Barahona, near Batoruco, *Fuertes* 1186, 1401 (*fide* Urban).

ST. THOMAS: Signal Hill, *Eggers* (*fide* Urban).

4. *Canavalia nitida* (Cav.) Piper.

Clementea nitida Cav. Anal. Cienc. Nat. 7: 63. 1804. Type grown in the Botanical Garden at Madrid from seed sent from Cuba.

Canavalia bahamensis Britton, Bull. N. Y. Bot. Gard. 4: 119. 1906. Described from specimens from Abaco and Eleuthera.

Canavalia ekmani Urban, Repert. Nov. Sp. Fedde 13: 317. 1918. Type from Cojimar, Habana, Cuba, *Ekman* 364. Other specimens cited are *Shafer* 587 and *Wilson* (? *Shafer*) 11517.

Stems twining, terete, reflexed-strigillose; petioles glabrous or nearly so; petiolules puberulent; leaflets coriaceous, elliptic to ovate-elliptic or oblong-lanceolate, often abruptly narrowed toward the tip, obtuse or sometimes emarginate at apex, rounded or truncate at base, glabrous, 4 to 7 cm. long; peduncles stout, shorter than the 10 to 50-flowered thyrses; pedicellar glands prominent; bracteoles orbicular, 1 mm. long, ciliolate; calyx campanulate, 6 to 8 mm. long, glabrous, the broad upper lip emarginate, as long as the tube, the lower lip 2.5 mm. long, 3-lobed; corolla purple; standard with a claw 5 mm. long, the blade 11 mm. long, orbicular, reflexed, auriculate at base; wings 14 mm. long, unguiculate, auricled, pink; keel falcate, as long as the wings, auricled, pink; ovary sericeous, 12-ovuled; style glabrous; pods dark brown, somewhat wrinkled, linear-oblong, compressed, 10 to 15 cm. long, stipitate, beaked, each valve with a single rib very near the ventral suture; seeds red, 15×12×12 mm., the linear hilum one-fourth the circumference.

BAHAMAS: Marsh Harbor, Abaco, *Brace* 1620 (N. Y., U. S.), type of *C. bahamensis*. Tarpum Bay, Eleuthera, *Coker* 411 (N. Y.). Mangrove Bay, Andros, *Brace* 4982 (U. S.). Staniard Creek, Andros, *Small & Carter* 8918 (U. S., Kew).

CUBA: Camagüey, *Shafer* 587. Sierra Guane, Pinar del Río, *Shafer* 10527 (U. S.). Sierra de Anafe, *Shafer* 11517 (U. S.). Sumidero, *Shafer* 13518 (U. S.). Without locality, *Rugel* (N. Y.).

No characters have been detected by which *C. bahamensis* and *C. ekmani* can be kept distinct. With scarcely room for doubt, *Clementea nitida* Cav. is the same thing, as indicated by Cavanilles's detailed description and figure. In herbarium specimens, however, the leaves can scarcely be called shiny.

5. *Canavalia macropleura* Piper, sp. nov.

Probably a climbing vine; stems woody, terete, sparingly reflexed-strigillose; petioles sparsely strigillose, 12 to 20 cm. long, about equaling the leaflets; stipules caducous, not seen; petiolules 7 mm. long, densely hirsutulous with stiff hairs; stipels subulate, persistent, 4 mm. long; leaflets membranous, thinish, ovate or elliptic-ovate, rounded at base, acuminate and apiculate at apex, finely reticulate, becoming glabrous above, sparsely strigillose beneath, 15 cm. long; peduncles stout, strigillose with reflexed hairs; thyrses about 12-flowered, the pedicels very short; bractlets orbicular; calyx campanulate, sparsely strigillose, 18 mm. long, the broad upper lip emarginate, the lower lip with 3 ovate teeth about 2 mm. long, the middle one longest; corolla 4 cm. long; standard orbicular, erect in anthesis, longer than the wings; keel curved, somewhat produced; pods on pedicels 1 to 2 cm. long, the young pods strigillose; mature pods linear, brownish, much compressed, sharply apiculate with a recurved beak, 28 cm. long, 4 cm. broad, the inner layer closely adherent, each valve with a broad longitudinal rib near each suture, the ventral one 10 mm. broad, the dorsal one 5 mm. wide; seeds dark brown, semicircular in outline, much compressed, $27 \times 18 \times 4$ mm., the linear hilum about the whole length of the convex border, over half the circumference of the seed.

Type in the Kew Herbarium, collected in Venezuela, a few miles north of the Colombian border, by August Fendler (no. 251). This specimen is in fruit. Flowering specimens were collected near Tovar, Venezuela, by Fendler (no. 248).

Very well marked by the two broad ribs on each valve. The only good flower on the specimen was not dissected.

6. *Canavalia parviflora* Benth. in Mart. Fl. Bras. 15¹: 177. 1859-62.

Stems woody, terete, glabrous; leaflets thin, slightly coriaceous, oval to ovate, abruptly short-acuminate, with blunt and apiculate tip, rounded or truncate at base, sparsely strigillose on both faces, 6 to 10 cm. long, 4 to 6 cm. broad; petioles shorter than the leaflets, glabrous or nearly so; petiolules 5 to 7 mm. long, glabrous or puberulent; stipules and stipels not seen; peduncles much shorter than the 15 to 30-flowered thyrses, the pedicellar glands prominent. hemispheric; bracteoles orbicular; calyx 10 mm. long, glabrous or sparsely strigillose, the upper lip broad, emarginate, the lower lip 1.5 mm. long, with 3 small ovate thin-margined teeth, the median slightly narrower and longer; standard 1.5 cm. long, thickish, almost orbicular, deeply emarginate, strongly nerved, reflexed in anthesis, bicallose near the base, the callosities puberulent, auricled at base, the auricles inflexed, the slender claw half as long as the blade; wings 13 mm. long, oblanceolate, concave, gradually attenuate at base into the claw, bearing an elongate recurved auricle just below the middle; keel 12 mm. long, the blade rhomboid and each petal bearing an inflexed auricle at base, the slender claw as long as the blade; style exceeding the stamens, sparsely bearded on the lower side; stigma capitate; mature pods thick, woody, brown, glabrous, straight, 10 cm. long, 3 cm. broad, with a short sharp incurved beak and bearing two sharp ribs, one very close to each suture; seeds $18 \times 10 \times 2$ mm., oblong, much compressed, brown, shiny; hilum linear, nearly as long as the seed and more than one-third its circumference.

BRAZIL: Rio de Janeiro, *Riedel* 446, in fruit (U. S.). Without locality, *Pohl*, type (Kew). Rio de Janeiro Province, *Glaziou* 6508 (Kew). Minas Geraes Province, *Claussen* 134, 45 (Kew).

Bentham cites also specimens from Piauhy Province, *Martius*; Goyaz Province, *Weddell*; and Rio de Janeiro, *Luschnath*.

7. *Canavalia variicolor* Piper, nom. nov.

Canavalia ensiformis versicolor Kuntze, Rev. Gen. Pl. 3²: 55. 1898. Not *C. versicolor* Rodrig. 1894.

Stems herbaceous(?), terete, slender, sparsely strigillose; petioles strigillose, longer than the leaflets; petiolules puberulent; leaflets membranaceous, broadly ovate, acuminate and apiculate, rounded or truncate at base, glabrous above, puberulent on the veins beneath, finely reticulate, 3-nerved from the base, 5 cm. long, nearly as broad; peduncles about as long as the inflorescence; thyrses about 10-flowered; pedicellar glands very prominent, bud-shaped; flowers not seen; pod (nearly mature) sessile, finely strigillose, nearly straight, linear, compressed, short-beaked, brownish, 13 cm. long, 1.6 to 1.8 cm. broad, each valve with 3 small ribs, one rib near each suture, the third 4 mm. from the ventral rib; seeds immature, the hilum as long as the seed.

BRAZIL: Villa Maria, Mattogrosso, *Kuntze* (U. S.).

Kuntze's description is very brief and relates merely to the color of the flowers, "petals yellow or ochraceous, the vexillum at length bluish." The plant differs from all other known *Canavalias* in the peculiar leaflets, palmately 3-ribbed from the base.

8. *Canavalia puberula* Piper, sp. nov.

Whole plant whitish-puberulent; stems slender, terete, herbaceous; petioles much shorter than the leaflets; petiolules 4 mm. long; stipules and stipels not seen; leaflets membranaceous, oval or slightly ovate, short-acuminate, with very blunt apiculate tip, obtuse to rounded at base, densely white-puberulent on both faces, 5 to 10 cm. long; peduncles about equaling the 10 to 20-flowered thyrses; pedicellar glands prominent; bracteoles minute, orbicular; calyx campanulate, 10 mm. long, the broad emarginate upper lip shorter than the tube, the lower lip 3 mm. long, with three triangular acute teeth, the median longer and thicker than the lateral ones; corolla 20 to 25 mm. long, the petals of equal length; standard broadly obovate, deeply notched, reflexed, attenuate at base to a short broad claw, bilauriculate at base, the auricles inflexed, bearing two lunate callosities near the base where the petal is reflexed; wing oblong-spatulate, obtuse, a short blunt tooth near the middle, an oblong auricle near the base, the claw short; keel falcate, the petals united from above the middle nearly to the blunt tip, each with an acute basal auricle and a short claw; stamens monadelphous; style glabrous; stigma capitate; young pods densely sericeous, with 3 ribs on each valve, one near each suture, the third near the middle.

Type in the herbarium of the New York Botanical Garden, collected in Santa Marta, Colombia, by H. H. Smith (no. 2047). Specimens of the same collection are in the U. S. National Herbarium and at Kew.

VENEZUELA: Guegue, Jan. 25, 1855, *Fendler* 271 (Kew).

Probably a species of the section *Eucanavalia*.

9. *Canavalia maritima* (Aubl.) Thou. Journ. de Bot. Desv. 1: 80. 1813.

Dolichos maritimus Aubl. Pl. Guian. 765. 1775. Based on a plant from French Guiana.

Dolichos roseus Swartz, Prodr. Veg. Ind. Occ. 105. 1788. Apparently based on *Dolichos maritimus repens* P. Br. Civ. Nat. Hist. Jam. 293.

Dolichos rotundifolius Vahl, Symb. Bot. 81. 1790-94. Based on specimens sent from the Caribbean Islands.

Canavali maritima Thou. Journ. de Bot. Desv. 1: 80. 1813. Thouars gets his specific name *maritima* from Plukenet, whereas Aublet takes it from Plumier.

Canavalia cathartica Thou. Journ. de Bot. Desv. 1: 80. 1813.

Dolichos miniatus H. B. K. Nov. Gen. & Sp. 6: 441. 1823. Specimens from Batabano and Cayo Flamingo, Cuba.

Canavalia miniata DC. Prodr. 2: 404. 1825. Based on the preceding.

Canavalia rosea DC. Prodr. 2: 404. 1825.

Dolichos littoralis Vell. Fl. Flum. 7: 301. pl. 160. 1825. "Ad littora maris Pharmacopolitana," Brazil.¹

Stems herbaceous, terete, sparsely strigillose, 3 to 10 meters long, prostrate when growing on open beaches but climbing where support is available; petioles about as long as the leaflets; stipules triangular-ovate, small, thickened at base; leaflets rather thickish, oval or ovate to orbicular, obtuse to retuse and usually apiculate at apex, sparsely strigillose on both sides when young, 5 to 8 cm. long; peduncles stout, the naked part about as long as the leaves; thyrses 6 to 30-flowered; calyx campanulate, sparsely strigillose, 2-lipped, the upper lip broad, emarginate, nearly as long as the tube, the lower lip 3-toothed, the lobes triangular, obtuse; corolla rose-colored; standard obovate, emarginate, 10 to 15 mm. long, auricled at base and bearing two lunate callosities; wings as long as the keel, oblong, obtuse, falcate, unguiculate, auricled at base of blade; keel blunt, curved, unguiculate, auricled at base; stamens monadelphous; style glabrous; stigma capitate; pod linear-oblong, nearly straight, beaked at apex, scarcely compressed, sparsely strigillose, 7 to 15 cm. long, 2 to 2.5 cm. broad, each valve with a longitudinal rib close to each suture and a third one 3 to 5 mm. from the ventral suture; inner layer loose and separating; seeds 4 to 9, ovoid to subglobose, brown and tawny marbled, 12 to 16 mm. long, 7 to 10 mm. broad, 4 to 9 mm. thick, the short hilum broadest at micropylar end, one-fifth of the circumference of the seed.

FLORIDA: Palm Beach, *Curtiss* 5522 (U. S., Kew); October, 1877, *Garber* (U. S.). Eastern Florida, *Curtiss* 682 (U. S., Kew). Cedar Keys, April, 1876, *Garber* (U. S.). Sugar Loaf Key, *Pollard, Collins & Morris* 71 (U. S.). Captiva Island, *Tracy* 7721 (U. S.). Fort Myers, *Hitchcock* 90 (U. S.). Punta Rassa, *Miss J. P. Standley* 255; *Hitchcock* 54 (U. S.). Coon Key, *Simpson* 255, 279 (U. S.). St. Vincent Island, *McAtee* 1844 (U. S.).

LOUISIANA: Breton Island, *Tracy & Lloyd* 184 (U. S.).

BERMUDA. South Shore, *Collins* 443 (U. S.); June 3, 1905, *Harshberger* (U. S.). Paget, *Brown & Britton* 133 (U. S., Kew).

BAHAMAS: Nassau, *Curtiss* 114 (U. S., Kew). Without locality, *Robinson* 28 (Kew). Deep Creek, Andros, *Brace* 5112 (U. S.). Pompey Bay, Acklin Island, *Brace* 4416 (U. S.).

CUBA: Cayo Sabinal, Camagüey, *Shafer* 1121 (U. S.). Manzanillo, *Shafer* 12351 (U. S.). Cayo Coco, Camagüey, *Shafer* 2686 (U. S.). Balabano, *Baker & Wilson* 2386 (U. S.). Playa de Marinao, *Palmer & Riley* 852 (U. S.).

¹ The more involved synonymy based on Old World plants and closely related species is discussed by Piper and Dunn (Kew Bull. Misc. Inf. 1922: 138. 1922). *Dolichos obtusifolius* Lam. (Encycl. 2: 295. 1786), described from Santo Domingo and the basis of *Canavalia obtusifolia* DC. (Prodr. 2: 402) is obscure. It is described as having red seeds, so that Urban (Symb. Antill. 8: 308. 1910) suspects it may be *Canavalia rusiosperma* Urban.

Cabañas, *Palmer & Riley* 752 (U. S.). Mariel, *Palmer & Riley* 726 (U. S.). Vivijagua, Isle of Pines, *Britton & Wilson* 14693 (U. S.).

PORTO RICO: San Juan, *Underwood & Griggs* 925 (U. S.). Isabel Segunda, *Shafer* 2401 (U. S.). Arecibo, *Cook & Collins* 1054 (U. S.). Catano, *Cook & Collins* 987 (U. S.). Santurce, *Heller* 52 (U. S., Kew).

ST. VINCENT: *Guilding* (Kew).

ST. THOMAS: Soldier's Bay, *Eggers* 318 (Kew).

ST. CROIX: Frederiksted, *Rose, Fitch & Russell* 3504 (U. S.); *Ricksecker* 25 (U. S.).

DOMINICA: *Imray* 34 (Kew).

MONTSERRAT: Plymouth, *Shafer* 365 (U. S.).

DOMINICAN REPUBLIC: San Pedro de Macorís, *Rose, Fitch & Russell* 4262 (U. S.). Santo Domingo, *Rose, Fitch & Russell* 3698 (U. S.). Haina, *Faris* 146 (U. S.).

GUADELOUPE: *Duss* 2652 (U. S.).

JAMAICA: Port Antonio, *Fredholm* 3057 (U. S.). Without locality, *Distin* (Kew).

BAHAMAS: Deep Creek, Andros, *Brace* 5112 (U. S.). Pompey Bay, Acklin's Island, *Brace* 4416 (U. S.).

DOMINICA: Rosalie, *Lloyd* 727 (Kew).

YUCATÁN: Chichancanab, *Gaumer* 1502, 1542, 2243 (Field). San Anselmo, *Gaumer* 1201 (Field).³

COSTA RICA: Boca Panamá, *Tonduz* 9146 (U. S.); W. W. & H. E. Rowlee 477 (U. S.).

PANAMA: Chagres, *Fendler* 80 (Kew, U. S.). Colón, *Hayes* 370 (Kew).

COLOMBIA: Santa Marta, *H. H. Smith* 292 (U. S., Kew). Cartagena, *Heriberto* 183 (U. S.). Western Colombia, *Cuming* 1204 (Kew).

BRITISH GUIANA: Without locality, *Lechmann*, January, 1918 (Kew); *Jenman* 2012 (Kew).

FRENCH GUIANA: Without locality, *Sagot* 147 (Kew).

BRAZIL: Without locality, *Sello*; *Martius* 1133 (Kew). Zapativa, *Pohl* (Kew). Fernando Noronha, *Ridley* (Kew).

GALÁPAGOS ISLANDS: Bindloe Island, *Snodgrass & Heller* 770 (U. S.).

10. *Canavalia apiculata* Piper, sp. nov.

Stems herbaceous, stout, terete, strigillose with reflexed hairs; petioles stout, strigillose, half as long as the leaflets; petiolules very strigillose, 5 mm. long; stipules triangular-ovate, thick at base; stipels subulate, stiff, somewhat persistent; leaflets membranaceous, thick, broadly obovate, rounded or abruptly acuminate-apiculate at tip, broadly deltoid at base, prominently reticulate, sparsely strigillose, shorter than the thyrses; peduncles stout, erect, about as long as the leaves, 6 to 8-flowered; pedicellar glands large; calyx campanulate, strigillose, longitudinally sulcate when dry, 10 cm. long, the broad emarginate upper lip shorter than the tube, the lower lip 3-toothed, the teeth ovate-triangular, the median longest; corolla 13 to 18 mm. long; standard obovate, emarginate, auricled, bicallose; wings as long as the keel; young pods densely silvery-strigillose; mature pods oblong-linear, stipitate, compressed, nearly straight, strongly beaked, 10 to 12 cm. long, 2 cm. broad, the valves thick, each with three longitudinal ridges, one near each suture, the third very prominent and 4 to 5 mm. from the ventral suture; seeds ellipsoid, compressed, dark brown, 12×9×5 mm.; hilum broadest at the micropylar end, one-fourth the circumference of the seed.

³These Yucatán specimens are not typical and may be distinct. The first-named locality is in the interior of Yucatán.

Type in the U. S. National Herbarium, nos. 209168 and 209169, collected at Manzanillo, Colima, Mexico, December 1-31, 1890, by Edward Palmer (no. 1024).

MEXICO: Altata, Sinaloa, *Rose* 1343 (U. S.). Clarion Island, *Anthony* 405, (Kew, Mo., U. S., Calif.; in fruit); *C. H. Townsend*, March, 1889 (U. S.).

Very closely allied to *C. maritima*, but the leaflets, and especially the seeds, differ.

11. *Canavalia ensiformis* (L.) DC. Prodr. 2: 404. 1825.

Dolichos ensiformis L. Sp. Pl. 725. 1753. The original basis of Linnaeus' species is the "Horse Bean" of Jamaica, described by Sloane (Cat. Pl. Jam. 1: 68. 1696).

Dolichos acinaciformis Jacq. Coll. Bot. 1: 114. 1786. Based on a twining plant grown in the greenhouse from West Indian seed and supposed to be different from *D. ensiformis*, described by Linnaeus as "erect."

Dolichos pugioniformis Gmel. Syst. Nat. ed. 13. 2: 1103. 1796, in part. Based on older descriptions, mainly of *C. ensiformis* but partly of *C. gladiata*.

Annual, usually bushy and erect, 1 to 2 m. high, the tips of the branches inclined to twine and in the shade becoming pronouncedly twining; stems stout, terete, sparsely strigillose with reflexed hairs; petioles usually longer than the leaflets; stipules lanceolate, thickened at base, minute, quickly deciduous; petiolules densely puberulent; stipels minute, subulate; leaflets membranaceous, oval to ovate, obtuse to acute, apiculate, 6 to 12 cm. long, strigillose at first on both faces but at length glabrous or nearly so; peduncles stout, 10 to 20-flowered; pedicellar glands prominent; bracteoles orbicular; calyx campanulate, 16 mm. long, the upper lip broad, emarginate, shorter than the tube, the lower lip 3-lobed, 4 mm. long, the lobes triangular, acute, the median thicker, narrower, somewhat concave; corolla 15 mm. long, rose-colored, gradually fading to white toward the base; standard oblong-orbicular, notched at apex, reflexed in anthesis, bearing two conical thickenings near the base of the blade, and at the base two inflexed semicircular auricles, the claw broad, 5 mm. long; wings oblong, obtuse, curved, unguiculate, the basal auricle thickish and inflexed; keel as long as the wings, falcate, the petals united except at base, unguiculate, an inflexed auricle on each side at the base of the blade; stamens monadelphous, the vexillar one free near the base, all free for the terminal one-sixth; style glabrous; stigma capitate, scarcely thickened; pods linear, slightly curved, stipitate, beaked at tip, scarcely compressed, 25 to 30 cm. long, 2 to 2.5 cm. wide, 12 to 20-seeded, each valve with three longitudinal ridges, one near each suture, the third 4 mm. from the ventral suture; inner layer thin, white, papery, separating; seeds ellipsoid, compressed, shiny white, 22×14×8 mm., the hilum grayish, 8 mm. long, about one-seventh the circumference, surrounded by an orange-brown narrow border.

Cultivated in the southern United States under the names Jack bean, Wonder bean, Giant Stock bean, Wataka bean, Pearson bean, etc. The plant is known to occur through the West Indies and in Panama, Guiana, Brazil, and Peru, but probably in all cases as a cultivated plant. While now widespread in the Tropics of both hemispheres, it is practically certain that the plant is native to America.

12. *Canavalia campylocarpa* Piper, Proc. Biol. Soc. Washington 30: 175. 1917.

Herbaceous annual, or under tropical conditions perhaps longer enduring; stems twining, green, branching, minutely and sparsely appressed-puberulent with white hairs, growing to a height of 2 to 4 meters; petioles about as long as the leaflets, sparsely puberulent; petiolules dark green, densely white-puberulent, somewhat swollen; leaflets membranaceous, ovate to oblong-

ovate, short-acuminate, sparsely puberulent, especially on the margins and the veins beneath, in age nearly glabrous, 10 to 18 cm. long; stipules triangular, acuminate, ciliate, 3 mm. long, quickly fugacious, but the base of each developing into a persistent green protuberance; stipels linear, the minute swollen base of each persistent; peduncles exceeding the subtending leaves; thyrses 5 to 10-flowered; pedicels very short, a group of swollen nectaries at the base of each; calyx green, sparsely puberulent, 10 to 12 mm. long, 2-lipped, the broad upper lip half as long as the tube and emarginate, the lower lip 3-lobed, the lobes small, subequal, triangular, acute; corolla pink; standard erect, broadly oval, deeply notched at apex, white in the center, the sides recurved, 2 cm. long, the broad claw 5 mm. long, the auricles oblong, obtuse, inflexed, 1 mm. long, the callosities conic; wings shorter than the keel, 22 mm. long, linear-oblong, concave, obtuse, the claw 5 mm. long, the auricles ovate, curved; keel 24 mm. long, incurved, obtuse, the claw 4 mm. long, the auricles ovate, incurved; stamens monadelphous; stigma capitate; pods much compressed, curved into a semicircle, 6 to 10 cm. long, 2 to 3 cm. broad, wax-yellow when immature, brown when ripe, finally white-puberulent, each valve with 3 longitudinal ridges, one close to each suture, the third 5 mm. from the ventral ridge; seeds oval in outline, compressed, 12 to 18 mm. long, wax-brown, the linear black hilum four-fifths as long, about one-fourth the circumference.

The peculiar pods well distinguish it from any other species as yet described. The seed of this plant was sent to the U. S. Department of Agriculture by John R. Bovell, Esq., Department of Agriculture, Bridgetown, Barbados, under the name "Babricou bean." In Antigua it has been used as a green manure crop. Presumably it is native to the West Indian region.

13. *Canavalia plagiosperma* Piper, Bull. Misc. Inf. Kew 1922: 141. 1922.

Annual; whole herbage sparsely strigillose; stems terete, climbing, one to several meters long; petioles as long as the leaflets; leaflets membranaceous, obscurely reticulate, broadly ovate, rounded or obtuse at base, acutish, 10 to 13 cm. long; petiolules puberulent; thyrses about 10-flowered; calyx green, spotted with blackish, strigillose, the upper lip emarginate, the lower lip with three broad deltoid acute subequal teeth; corolla purple, the wings as long as the blunt keel; pods linear, much compressed, nearly straight, strigillose, 20 to 25 cm. long, 4 cm. broad, tipped with a recurved beak, the intermediate ridge 5 mm. from the sutural one; seeds about 10, ellipsoid, much compressed, somewhat shiny, abruptly narrowed at the micropylar end, $27 \times 17 \times 10$ mm., ochraceous salmon (Ridgway); hilum lanceolate, 10 mm. long, wholly on the oblique micropylar end of the seed, black, encircled by a narrow brown band.

Obtained from Dr. P. Boname, Director of Agriculture, Mauritius, the seed originally from Cuba, and grown at Biloxi, Mississippi; Miami, Florida; and in the greenhouse at Washington, D. C., No. 02053 (type; also from Nicaragua, No. 02735.

Easily distinguished from any other species by its peculiar seeds.

14. *Canavalia arenicola* Piper, sp. nov.

Stems herbaceous, terete, sparsely strigillose; petioles sparsely strigillose, shorter than the leaflets; stipules and stipels not seen; petiolules 5 mm. long, pubescent; leaflets membranaceous, thickish, oblong to elliptic, obtuse or retuse, rounded at base, glabrous, 5 to 7 cm. long, half as wide; peduncle terete, strigillose, longer than the few-flowered thyrses; bracteoles orbicular; calyx campanulate, strongly nerved, sparsely strigillose, 10 mm. long, the broad emarginate upper lip shorter than the tube, the lower lip 3 mm. long, with triangular teeth; corolla "rouge violet," 2 cm. long; petals subequal in length;

keel blunt; pods densely strigillose when young, glabrous when mature, linear, compressed, dark brown, smooth, 12 cm. long, 3 cm. broad, 3-ribbed, one rib close to each suture, the third more prominent and 5 mm. from the ventral rib; inner layer separating when mature; seeds oval in outline, somewhat narrowed at the micropylar end, much compressed, $18 \times 12 \times 5$ mm.; hilum oblong-linear, nearer to the micropylar end, 10 mm. long, or about one-fifth the circumference.

Type in the Kew Herbarium, collected at Coyaquilla, Michoacán or Guerrero, Mexico, in sandy places, June, 1898, by E. Langlassé (no. 734).

Readily distinguished from any form of *C. maritima* by the pods and seeds.

15. *Canavalia mexicana* Piper, sp. nov.

Stems herbaceous, climbing, terete, sparsely strigillose with reflexed hairs; stipules minute, ovate, obtuse, purplish, quickly deciduous; petioles shorter than the leaflets, strigillose; stipels minute, linear; leaflets chartaceous, oval, acute or acutish or rarely acuminate, strigillose on both faces when young, glabrous in age, 5 to 7 cm. long; peduncles about 10 cm. long, equaling the 15 to 20-flowered thyrses; bracteoles broadly ovate to orbicular; calyx campanulate, sparsely strigillose, sulcate with many longitudinal grooves when dry, 10 mm. long; upper lip deeply emarginate, shorter than the tube; lower lip 3-lobed, the lobes triangular, acute, the middle one longer and narrower, 2 mm. long; corolla 2 to 2.5 cm. long; standard ovate, emarginate, reflexed, the auricles rounded and inflexed, the claw rather broad, the callosities thick; wings as long as the keel, oblanceolate, obtuse, auricled, unguiculate; keel falcate, truncate, the auricles narrow, the claw slender; style glabrous; stigma capitate; pod linear, 10 to 15 cm. long, strigillose when young, thick and firm, each valve with three ribs, one very near each suture, the third 3 mm. distant from the ventral rib; seeds ellipsoid, compressed, tawny, streaked with brown, 15 mm. long, 10 mm. wide, 5 mm. thick; hilum oblong, black, broadest at the micropylar end, encircled by a dark brown band, less than half as long as the seed, about one-sixth its circumference.

Type in the U. S. National Herbarium, nos. 567787 and 305542, collected at Imala, Sinaloa, Mexico, September 25 to October 8, 1891, by Edward Palmer (no. 1753).

MEXICO: María Madre Island, *Nelson* 4190 (U. S.). Guadalupe, Sinaloa, *Rose, Standley & Russell* 14787 (U. S.). Villa Unión, Sinaloa, *Lamb* 385 (U. S.); *Rose, Standley & Russell* 13979 (U. S.). Culiacán, Sinaloa, November 10, 1904, *Brandege* (U. S.). Acoponeta, Tepic, *Rose* 3363 (U. S.). Acapulco, *Palmer* 145 (Kew). Valley of Córdoba, *Bourgeau* 1758 (Kew, Gray). (The Bourgeau specimen is doubtfully referred to *C. mexicana*, as it has long-acuminate leaflets.)

SALVADOR: Gulf of Fonseca, *Sinclair* (Kew).

NICARAGUA: Without locality, *Wright* (Mo.).

GUATEMALA: Gualán, *Deam* 310 (Field). Between Cahabón and Secanquím, Alta Verapaz, *Goll* 125 (U. S.). Mazatenango, *Kellerman* 5688 in part (U. S.).

YUCATÁN: Mérida, *Schott* 729 (Field).

16. *Canavalia panamensis* Piper, sp. nov.

Stems herbaceous, terete, sparsely strigillose in indistinct lines, the hairs reflexed; petioles shorter than the leaflets, sparsely strigillose; petiolules puberulent, 5 mm. long; stipules subulate, appendaged at base, quickly fugacious, 2.5 mm. long; stipels aculeolate, minute; leaflets membranaceous, elliptic to ovate, rounded to deltoid at base, acuminate and obscurely apiculate at apex, finely reticulate-veined, sparsely strigillose, especially beneath, 6 to 10 cm. long; peduncles stout, 15 to 25 cm. long in fruit, 5 to 20-flowered; flowers

not seen; pods linear, stipitate, much compressed, nearly straight, short-beaked, finely strigillose, 12 to 14 cm. long, 2 cm. broad, the valves each with 3 longitudinal ridges, one very close to each suture, the third 3 to 4 mm. from the ventral suture; seeds 12, their position faintly visible from the outside, ellipsoid, compressed, tawny except for the dark brown border around the hilum, $12 \times 8 \times 5$ mm.; hilum nearly black, lanceolate, broadest at the micropylar end, 7 mm. long, about one-fifth the circumference.

Type in the U. S. National Herbarium, nos. 1,111,593-4, collected at Punta Paitilla, near Panama City, Panama, February 24, 1923, by C. V. Piper (no. 5168).

CANAL ZONE: Near Fort Amador, *Piper*. Corozal to Ancón, "flowers purplish," *Pittier* 2175.

This species is common near the seashore about Panama Bay, climbing the trees to a height of 15 to 20 feet.

17. *Canavalia paraguayensis* Piper, sp. nov.

Stems herbaceous, twining, terete, sparsely strigillose; petioles about as long as the leaflets; stipules and stipels early deciduous, not seen; petiolules densely puberulent; leaflets firm-membranaceous, oblong to oblong-ovate, rounded to cuneate at base, abruptly short-acuminate, rather prominently veined, glabrous above, strigillose beneath, 5 to 8 cm. long by half as broad; peduncles strigillose, as long as the young thyrses; racemes 20 to 25-flowered; bracteoles orbicular; calyx campanulate, sparsely strigillose, 15 mm. long, the broad upper lip emarginate, the small lower lip 3-toothed, the lateral ones obtusish, the middle one acute, narrower and longer; corolla 2.5 to 3 cm. long, "violet-white"; standard orbicular, emarginate, reflexed in anthesis, bearing two linear callosities just below the middle, the broad claw 5 mm. long, the auricles ovate-triangular; wings oblong, obtuse, as long as the keel, each with a broad rounded lobe near the middle, the auricles oblong, the claw 5 mm. long; keel petals united for more than half their length but free at tips, the auricles narrowly oblong; stamens monadelphous; style glabrous; pods 17 cm. long, 1 cm. broad, straw-colored, one longitudinal ridge close to each suture the third 5 mm. distant from the ventral ridge; seeds about 12, oval, $13 \times 10 \times 6$ mm., shiny, Dresden brown (*Ridgway*); hilum broadly oblong, half as long as the seed, encircled by a narrow brown band.

Type in the Gray Herbarium, collected between Río Apa and Río Aquidaban, Centurión, Paraguay, December 10, 1908-09, by K. Fiebrig (no. 4395).

PARAGUAY: Asunción, *Morong* 694, 624 (Gray, N. Y.; *Morong's* 694 is in the Gray Herbarium numbered 649). Cordillera de Altos, *Hassler* 2951 (*Kew*).

Notes on *Morong's* 694 were published in the *Annals of the New York Academy of Science* (7: 84. 1892) under the name *C. ensiformis* (L.) DC., but there was associated with it *Morong's* 639, which is *Phaseolus caracalla* L., so that the notes are confused.

18. *Canavalia fendleri* Piper, sp. nov.

Stems herbaceous (?), terete, sparsely strigillose with reflexed hairs; petioles stout, sparsely strigillose, equaling or shorter than the leaflets; stipules not seen; stipels aculeolate, sometimes persisting; petiolules 5 to 7 mm. long, densely puberulent; leaflets thin-membranaceous, broadly oval, acuminate with acutish and apiculate tip, rounded or truncate at base, pale green, glabrous or nearly so above, sparsely strigillose beneath, 10 to 13 cm. long, 6 to 10 cm. broad; peduncles stout, about as long as the thyrses; pedicellar glands prominent; thyrses 20 to 25-flowered; bracteoles broadly ovate, acutish; calyx campanulate, sparsely strigillose, 10 to 12 mm. long, the broad upper lip emarginate, the lower lip 2.5 mm. long, with triangular acute teeth, the median

slightly longer and thicker; corolla "light purple" or "white"; petals equal in length; standard broadly oblong, notched at apex, 3 cm. long, narrowed at base into a short broad claw, bearing two small inflexed auricles at base and just above the claw two lunate callosities; wings linear-oblong, short-unguiculate, the oblong basal auricle inflexed; keel falcate, the petals united from just above the middle nearly to the tip, each oblong auricle slightly inflexed, the claws slender; stamens monadelphous; anthers oblong; style glabrous; stigma capitate; pods densely strigillose when young, glabrous or nearly so when mature, linear, stipitate, beaked at tip, 15 to 20 cm. long, 3 cm. broad, the inner layer separating, 8 to 12-seeded, 3-ribbed on each valve, one rib close to each suture, the third 5 mm. from the ventral rib; seeds ellipsoid, $15 \times 10 \times 7$ mm., ochraceous; hilum oblong, broadest at the micropylar end, 10 mm. long or about one-fifth the circumference of the seed.

Type in the Kew Herbarium, collected at Biscaina, Venezuela, September 7, 1855, by August Fendler (no. 248). A specimen of the same collection is in the herbarium of the Missouri Botanical Garden.

VENEZUELA: Caracas, L. H. & Ethel Zoe Bailey 300 (U. S.) Ciudad Bolivar, L. H. & Ethel Zoe Bailey 1908 (U. S.).

COLOMBIA: Santa Marta, H. H. Smith 289, 290 (Kew, N. Y., Mo., U. S.).

19. *Canavalia leptophylla* Piper, sp. nov.

Annual, herbaceous, twining, growing to a height of 2.5 meters or more, the whole herbage sparsely strigillose; stems terete; petioles as long as the leaflets; stipules narrowly lanceolate, very early fugacious; leaflets thin-membranaceous, ovate-oblong to slightly obovate, sharply acuminate, rounded or truncate at base, densely but minutely ciliate, 6 to 12 cm. long; petiolules densely puberulent; stipels minute, lanceolate; thyrses few-flowered; calyx green, sparsely strigillose, the large upper lip emarginate, the lower lip with three small acute teeth, the middle one narrower and twice as long as the lateral ones; corolla pale violet, 2 cm. long, the wings as long as the blunt keel; pods linear, straight, with a recurved sharp beak, dark-colored, sparsely strigillose, 12 to 20 cm. long, 2 to 2.5 cm. broad, conspicuously angled by the intermediate ridge, this 5 to 6 mm. from the suture, the sides of the valves nearly flat; seeds 5 to 10, olive-ochre to dark olive-buff (Ridgway), ellipsoid, somewhat compressed, 12 to 16 mm. long, 8 to 10 mm. wide, 8 mm. thick; hilum lanceolate or broadest at micropylar end, bordered by a narrow band of dark brown, three-fourths as long as the seed, nearly one-third its circumference; first true leaves of seedlings unifoliate, broadly ovate, subcordate, conspicuously and sharply acuminate.

Type in the U. S. National Herbarium, no. 1,021,963, collected at Huigra, Ecuador, altitude about 1,200 meters, August 22, 1918, by J. N. Rose (no. 22295), and cultivated in the greenhouse at Washington, D. C.

Rusby & Pennell 307 (N. Y.), July 24, 1917, from Quebrada de Angeles above Natogaima, Colombia, is apparently the same.

20. *Canavalia gladiata* (Jacq.) DC. Prodr. 2: 404. 1825.

Dolichos gladiatus Jacq. Coll. Bot. 2: 276. 1788. Jacquin described the species from plants grown in the greenhouse at Vienna.

Canavalia maxima Thou. Journ. de Bot. Desv. 1: 78. 1813. Thouars' name is based on the Bara-mareca of Rheede, a plant of Malabar, India.

Annual or in the tropics perhaps perennial, climbing to a height of several meters; stems green, reflexed-strigillose when young, at length glabrous or nearly so; stipules lanceolate, thickened at base, quickly fugacious; petioles shorter than the leaflets; petiolules puberulent; stipels subulate, minute;

leaflets membranaceous, broadly ovate, acuminate at apex, the very tip acute or obtuse but apiculate, truncate at base, glabrous or nearly so, 10 to 12 cm. long; peduncles stout, exceeding the leaves, 10 to 40-flowered; pedicellar glands prominent; calyx campanulate, 15 to 20 mm. long, strigillose, the broad upper lip emarginate, shorter than the tube, the lower lip 3-lobed, 3 to 4 mm. long, the lobes triangular-ovate; corolla pale pink or pink-tinged, 15 to 18 mm. long; standard ovate-orbicular, emarginate, reflexed in anthesis, unguiculate, bearing two conical callosities near the base of the blade and a pair of inflexed auricles at the base; wings as long as the keel, oblong, obtuse, curved, unguiculate, auriculate at base; keel falcate, the petals united toward the tip, each unguiculate and auricled at base; style glabrous; stigma capitate; pod densely strigillose when young, becoming glabrous; pod linear, compressed, slightly curved, stipitate, beaked, straw-colored, 20 to 35 cm. long, 3.5 to 5 cm. broad, 8 to 16-seeded, each valve with a longitudinal ridge close to each suture and a third more prominent one 4 to 7 mm. from the ventral suture; inner layer thin, papery, white, separating; seeds ellipsoid, compressed, 22 to 35 mm. long, 16 to 20 mm. broad, 5 to 6 mm. thick, the hilum 15 to 20 mm. long, about one-fourth of the circumference.

The sword bean is known only as a cultivated plant and may be a derivative of the wild *C. virosa* (Roxb.) Wight & Arn., a native of India and the nearest known wild species. There are several very distinct cultivated varieties of the sword bean. The most common is the typical form with dark red seeds. In India and Burma occurs also a variety with ochraceous colored seeds, *C. gladiata spodiosperma* Voight. In China the common variety has rather pale, dull red seeds which shrink when dry. This same variety occurs in Japan, and in addition one with white seeds. In this last form the pods are less compressed and usually wrinkled on the surface; the seeds are likewise relatively thicker and the hilum narrow and often slightly sunken. It is the "natta-name" of the Japanese, and probably the basis of *Dolichos incurvus* Thunb. (Fl. Jap. 280. 1784; *Canavalia incurva* DC.), although Thunberg's description is faulty.

All the varieties have been cultivated more or less in America, but the commonest is the typical form with dark red seeds.

21. *Canavalia caribaea* Urban, Symb. Antill. 7: 232. 1912.

Stems herbaceous (?), terete, densely strigillose when young with reflexed white hairs; petioles slender, strigillose, shorter than the leaflets; petiolules 4 mm. long, densely puberulent; stipules not seen; stipels aculeolate; leaflets membranaceous, ovate, short-acuminate, with apiculate tip, sparsely strigillose on each surface, closely reticulate, dark green, 5 to 8 cm. long, 3 to 5 cm. broad; peduncles strigillose with reflexed hairs, about equaling the thyrses; calyx campanulate, sparsely strigillose, 10 mm. long, the broad emarginate upper lip shorter than the tube, the lower lip 3 mm. long, with triangular acute teeth; corolla 2.5 cm. long, the petals of equal length; standard with 2 linear median callosities below the middle; keel falcate, obtuse; pods densely strigillose when young, glabrous or nearly so when mature, linear, beaked at tip, dark brown, smooth, 15 cm. long, 3 cm. wide, stipitate, the inner layer separating, 3-ribbed, one rib close to each suture, the third 3 to 4 mm. from the ventral rib; seeds ellipsoid, compressed, brown, $17 \times 10 \times 5$ mm., a narrow darker border about the hilum; hilum 13 mm. long, about two-fifths the circumference of the seed.

ANTIGUA: *Rose, Fitch & Russell* 3312 (U. S.).

ST. VINCENT: *H. H. & G. W. Smith* 1638 (Kew).

Urban cites the following specimens: Bocolet River at Calder Hall, Tobago, *Eggers* 5705 (type). Tobago, *Broadway* 3446, 3857. St. Vincent, *Smith* 1179.

From Urban's long descriptions of the floral parts, not possible with our scanty material, the following details are compiled: Standard obovate, deeply notched, 2.5 cm. long, auriculate, bicallose, the claw 5 mm. long.

22. *Canavalia boliviana* Piper, sp. nov.

Herbaceous; stems stout, terete, sparsely strigillose; petioles stout, sparsely strigillose, half as long as the leaflets; stipules triangular, 2 mm. long; stipels aculeolate; petiolules puberulent, 6 mm. long; leaflets membranaceous, broadly oval to ovate, 7 to 12 cm. long, 5 to 10 cm. broad, truncate to broadly deltoid at base, very abruptly acuminate to a short broad tip, this obtuse and apiculate, very sparsely strigillose on both surfaces, the 5 or 6 pairs of lateral nerves prominent; peduncles stout, exceeding the leaves, 10 to 30-flowered; pedicellar glands prominent; calyx campanulate, 14 mm. long, nearly glabrous, the upper lip emarginate, shorter than the tube, the lower lip 3-toothed, the lateral lobes obtuse, the median slightly longer, ovate, acutish; bracteoles orbicular; corolla purple, 4 cm. long; standard emarginate, the limb broadly ovate; wings spatulate-oblongate, shorter than the standard; keel much curved, broad; pods stipitate, linear, straight, much compressed, beaked with a recurved tip, dark brown, sparsely strigillose, 10 to 20 cm. long, 3 cm. broad, the intermediate rib most prominent and 2 to 3 mm. from the ventral rib; inner layer not separating; seeds ellipsoid, compressed, $15 \times 8 \times 5$ mm., olive-yellow, speckled and spotted with brown dots. the black hilum as long as the seed, broadest at the micropylar end, surrounded by a narrow border of brown.

Type in the U. S. National Herbarium, no. 1,122,148, collected at Espía, Bolivia, altitude 1,050 meters, July 25, 1921, in ripe fruit, by O. E. White (no. 616). The flowers are described from specimens grown at McNeill, Mississippi, from seeds of no. 616.

BOLIVIA: Espírito Santo, *Bang* 1274, young pods only (U. S.). Cocapata, *Bang* 2195, flowers just fallen, "climbing on high trees in the forest, the flowers blue" (U. S., Mo.).

23. *Canavalia amazonica* Piper, sp. nov.

Stems herbaceous, climbing, terete, strigillose when young, glabrate; petioles glabrous, shorter than the leaflets; stipules and stipels not seen; petiolules 5 mm. long, puberulent; leaflets membranaceous, oblong-oval, obtusish to acutish, cuneate at base, glabrous above, sparsely strigillose beneath, 8 to 10 cm. long, 6 cm. broad, widest in the middle; peduncles stout, 10 to 15 cm. long, as long or longer than the thyrses; pedicellar glands prominent; thyrses 15 to 25-flowered; bracteoles minute, orbicular; calyx campanulate, sparsely strigillose, 10 mm. long, the emarginate upper lip not as long as the tube, the lower lip 3-toothed, 2 mm. long, the teeth triangular-ovate; corolla "red," 12 mm. long; standard obovate, emarginate, bilauriculate (?), bearing two linear callosities below the middle; wings equaling the keel; keel falcate, obtuse, as long as the standard; pods densely strigillose when young, becoming glabrous, nearly straight, linear, compressed, brownish, hooked at tip, 15 cm. long, 2.5 cm. broad, 3-ribbed, one rib close to each suture the second 6 to 7 mm. distant from the ventral rib; seeds (scarcely mature) ellipsoid, compressed, brown, $16 \times 10 \times 4$ mm.; hilum linear, 13 mm. long about two-fifths the circumference of the seed.

Type in the Kew Herbarium, collected at Barra, Province of Rio Negro, Brazil, by Richard Spruce (no. 1468). *Spruce* 1868, collected in May, 1851, also belongs to this species.

24. *Canavalia dictyota* Piper, sp. nov.

Vine, herbaceous or perhaps shrubby at base; stems terete, strigillose with reflexed hairs when young, at length glabrous; stipules (not seen) quickly deciduous; petiole much shorter than the leaflets; petiolules densely puberulent; leaflets firm, almost chartaceous, lance-ovate, acute at apex, cuneate at base, sparsely strigillose on both surfaces especially beneath, prominently nerved, beautifully reticulate-veined, 6 to 8 cm. long, 3 cm. wide; peduncles stout, 10 cm. long; thyrses about 8-flowered; calyx campanulate, sparsely strigillose, 13 mm. long; upper lip broad, emarginate; lower lip with 3 small deltoid-ovate ciliate teeth, the lateral ones larger, 2.5 mm. long; corolla 2.5 cm. long; standard oval, emarginate at apex and with two thick callosities near the auriculate clawed base; wings obtuse at apex, each with a short lobe below the middle; keel blunt, as long as the wings; style glabrous; stigma capitate; ovary strigillose; pods linear, compressed, very firm and woody, tipped with a straight beak, strigillose when young, straw-colored to brown, 16 cm. long, 3 cm. wide, one ridge very close to each suture, the second 5 mm. distant from the ventral suture; seeds ellipsoid, compressed, 20 mm. long, 12 mm. wide, 7 mm. thick, reddish brown, marbled with longitudinal black bands, dull; hilum linear, 17 mm. long, encircled by a narrow dark brown band.

Type in the U. S. National Herbarium, no. 1,111,602, collected at mouth of Demerara River, British Guiana, April, 1887, by G. S. Jenman (no. 4211). A specimen of the same collection is in the herbarium of the New York Botanical Garden.

BRITISH GUIANA: Demerara, *Parker* (Kew). Vreed-en-Hoop, Demerara River opposite Georgetown, *Hitchcock* 16698 (U. S., N. Y.), "flower pinkish lavender."

FRENCH GUIANA: Cayenne, *Broadway* 452, 141 (N. Y.), "flowers rose-color, fragrant."

VENEZUELA: Los Chorros, near Caracas, *Bailey* 486, "cultivated" (U. S.).

BRAZIL: Seeds obtained from Pará, Brazil, S. P. I. no. 48600, are identical with Jenman's 4211, but none would germinate.

25. *Canavalia brasiliensis* Mart.; Benth. Ann. Wien. Mus. Naturg. 2: 135. 1838.

Herbaceous vine; stems slender, terete, strigillose; petioles sparsely strigillose, as long as the leaflets; petioles densely puberulent, 5 mm. long; stipules minute, triangular, acuminate, puberulent, quickly deciduous; stipels awl-shaped, minute, persisting; leaflets ovate to oval, membranaceous, very short-acuminate and minutely apiculate, rounded to obtuse at base, sparsely strigillose on both surfaces but more so beneath, 10 to 16 cm. long; peduncles stout, longer than the leaflets; thyrses 10 to 15-flowered; bracteoles ovate-orbicular; calyx campanulate, 13 to 15 mm. long, sparsely strigillose, the large upper lip emarginate, the lower lip with three small triangular acute teeth, the median longer, narrower, and thicker; corolla purplish, 2.5 cm. long; standard obovate, notched at apex, 2.5 cm. long, bearing 2 lunate callosities at base of blade, the broad claw 5 cm. long, the auricles ovate, inflexed; wings oblong, obtuse, unguiculate, as long as the keel, the oblong basal auricles inflexed; keel falcate, blunt, the petals united above the middle, each with a short claw and an ovate inflexed basal auricle; style glabrous; pods fuscous (*Ridgway*), linear, compressed, nearly straight, sparsely strigillose, 10 to 15 cm. long, 2 to 5 cm. broad, one ridge very near the ventral suture, the second 3 to 5 mm. distant; inner layer papery and separating; seeds ellipsoid, compressed, 10 to 13 mm. long, 7 to 8 mm. broad, 4 to 5 mm. thick, dull, Isabella color (*Ridgway*); hilum black, linear, surrounded by a dark brown narrow band, two-thirds as long as the seed, about one-fourth its circumference.

BRAZIL: "Sebastiano politanae in sylvis," *Martius* in 1817, apparently the type and that cited by Bentham as "In sylvis Catingas provinciae Bahia," specimen in flower (Munich). Piauhv Province, *Martius*, in young fruit (Munich). Bahia, *Salzmann*, in flower (Kew, Mo.). Utinga, Bahia, *Blanchet* 2748, in flower (Kew). Baixa Verde, Rio Grande do Norte, "growing over a cactus tree 25 feet high and aiding in its destruction; on very dry sandy soil," *E. C. Green*, S. P. I. no. 41816; cultivated in the greenhouse at Washington.

26. *Canavalia anomala* Piper, sp. nov.

Stems herbaceous, terete, sparsely strigillose; petioles sparsely strigillose, nearly as long as the middle leaflet; petiolules densely rusty-strigillose, 6 mm. long; leaflets membranaceous, broadly oval or slightly obovate, very short-acuminate but the tip blunt, narrowed and somewhat truncate at base, sparsely strigillose, 9 cm. long; peduncles shorter than the thyrses; calyx campanulate, sparsely strigillose, the upper lip broad, emarginate(?), the lower lip with three small triangular teeth; corolla not seen; young pod densely sericeous; pods linear, straight, dark brown, sparsely strigillose, 12 to 14 cm. long, each valve with four ribs, one near each suture, one 4 mm. distant from each of the sutural ribs, the median two more prominent; inner layer loose, papery; seeds ellipsoid, $13 \times 10 \times 7$ mm., clay-colored, a narrow brown border about the hilum; hilum rather broad, two-thirds the length of the seed and about one-fourth its circumference.

Type in the herbarium of the New York Botanical Garden, collected at edge of forest, three miles east of Masina, Santa Marta, Colombia, by H. H. Smith (no. 681). The specimen is in fruit.

There are two sheets of specimens, part of each being the foliage of a striate-stipuled plant, probably either *Bradburya* or *Clitoria*.

The species is unique in its pod characters.

SPECIES DOUBTFUL OR NOT SEEN.

Canavalia microsperma Urban, Symb. Antill. 5: 373. 1908.

"*Canavalia microsperma* Urb. (n. sp.) ramis hornotinis pilos parcos breves refractos gerentibus, mox glabrescentibus; foliolis ovali-ellipticis, apice plicato obtusissimis, 7.5–8.5 cm. longis, 3.5–4 cm. latis, chartaceo-coriaceis, glabris, nervis supra tenuiter prominentibus, parvum v. obsolete, subtus manifeste reticulato-anastomosantibus; legumine oblongo-lineari, 14–15 cm. longo, 3.5 cm. lato, compresso glabro, juxta suturam ventralem acutatam breviter bialato; seminibus 8–10, in sicco nigrescentibus, ca. 11 mm. longis, 9 mm. latis, hilo $\frac{2}{3}$ circuitus aequante."

"Volubilis. Rami teretes, plus minus striati. Stipulae triangulares, 1–1.5 mm. longae, valde deciduae. Folia 3–4 cm. longe petiolata; foliola lateralia 3.5–4 mm., terminale ca. 15 mm. longe petiolulata, hoc basi rotundatum, caetera subtruncata, apice ipso submarginata, nervo medio supra prominente, lateralibus 7–8 sub angulo ca. 60° abeuntibus. Inflorescentiae cum pedunculo ca. 7 cm. longo ca. 18 cm. longae; flores e vestigiis pluriatim e gibberibus prodeuntes; pedicelli fructiferi ca. 1 cm. longi. Legumen 7–10 mm. longe stipitatum, inter semina singula non constrictum, apice oblique truncatum, unilateraliter apiculatum, nervis transversis, obsoletis, alis lateralibus 2–3 mm. a margine ipso distantibus, 1–1.3 mm. altis, in sicco bruneum. Semina oblique ovato-rotundata, convexa, 6 mm. crassa, hilo lineari."

"Hab. in Cuba: Ramón de la Sagra."

CANAVALLIA RUTILANS DC. Prodr. 2: 404. 1825.

"*C. rutilans*, foliolis ovali-oblongis obtusis, leguminibus rectis latitudine quadruplo longioribus. In Mexico. *Mucuna rutilans* fl. mexic. ined. Flores seminaque rubro-punicea. Forsan à *C. obtusifolia* vix diversa."

CLITORIA BRASILIANA Vell. Fl. Flum. 7: 293. pl. 129. 1825.

"*Clitoria brasiliana*. *C.* foliis ternatis, foliolis ovatis; perianthii denticulo producto, uncinato. (Tab. 129a, T. 7.)

OBSERVATIONES.

"Perianthium quadri-dentatum, tribus minimus, singulari ampliore, productiore, rostrum uncinatum efficiente. Ab altero alae latere denticulus unus; legumen latum, ab altero latere carinatum, ad apicem declinatum, rostratum. Semina reniformia, plurima, compressa. Habitat silvis maritimis."

Bentham (Mart. Fl. Bras. Addenda 15: 326) guesses Vellozo's plant to be *Canavalia gladiata* (L.) DC. We can not agree, but think that the plate is a fairly good representation of *Canavalia brasiliensis* Mart. It has nothing at all to do with *Clitoria brasiliana* L., which is *Centrosema brasilianum*.

CANAVALIA VERSICOLOR Rodrig. Pl. Nov. Cult. Jard. Bot. Rio Janeiro 4: 5. pl. 2. 1894.

"*Canavalia versicolor* Barb. Rod., caule alte volubili, foliolis ellipticis, obtusi-acuminatis, lateralibus inaequilateris; calycis labio superiore magno, bilobo, tubo triplo brevior, inferiore minutissimo, trilobo; ala intus supra auriculam pulvinata; carina incurva, erostri.

"*Tabula nostra II.*

"*Caules* alte volubiles, glabri, ramosi. *Folia* trifoliata. *Petioles* antice sulcati, 0.^m07-0.^m09 lg. *Foliola* elliptica, obtusi-acuminata, lateralia inaequilatera, basi subcordiformia, crassiuscule membranacea, glabra, 0.^m10-0.^m001×0.^m07-0.^m08 lg. *Pedunculi* 0.^m20-0.^m25 lg., penduli, multiflori; nodi tuberculiformes parum distantes, 2-6-flori. *Bracteae* obsoletae. *Flores* erecti, breviter pedicellati, rosei vel coccinei. *Calix* glaber, tubo latiusculo, compresso, 0.^m008 lg., labium superius dilatatum, tubo triplo minore, rotundatum, inferiores lobi 0.^m001-0.^m002 lg., laterales acuti, intermedius longior. *Vexilli* unguis complicatus, incurvus, lamina late oblonga, profunde emarginata, reflexa, basi complicata auriculus inflexis appendiculata, medio albo-bicallosa. *Alae* unguiculatae, falcato-oblongae, margine interiore sinuatae, superiore incurvae, basi longe auriculatae et hic interioriter pulvinatae. *Carina* alas paulo superans eisque latior, incurva, longe unguiculata. *Ovarium* segmoideum, breviter stipitatum glabrum.

"Hab. in silvis prope Rio de Janeiro, S. Paulo et in Horto botanico Fluminensi No. 2066 *culta*. Feijao Fava bravo *vulgo*. *Florebat* Februario."

In a long discussion Rodrigues compares his plant with *C. maritima* (*C. littoralis* Vell.) and emphasizes that it is a climber and blooms in February, while the seashore plant flowers in August. *C. maritima*, however, is always a climber if it can secure support, as in common cultivation, and as is often seen on the coast of Florida. The shape of the leaflets of *C. versicolor* as figured differs from all forms of the variable *C. maritima* known to the writer, which leads us to regard Rodrigues' species as valid.

CANAVALIA ENSIFORMIS ALBIDA DC. Prodr. 2: 404. 1825.

This is based on Mocino and Sessé's unpublished plate of a Mexican plant and described simply as having the flowers and seeds white. *C. ensiformis* is, in our experience, always a red-flowered plant, but a white-flowered variant would not be strange.

WENDEROTHIA Schlecht.

DESCRIPTION OF THE GENUS.

Herbs or shrubs, mostly twining; leaves pinnately trifoliolate; petioles sulcate above; petiolules rather fleshy; stipules caducous, thin, not striate; peduncles axillary; flowers numerous, in raceme-like thyrses, two or more short pedicels often arising from each prominent pedicellar gland; bracts minute, caducous; bracteoles mostly orbicular, caducous; calyx tubular-campanulate, bilabiate, the upper lip large, entire, the lower small and three-lobed; standard large, reflexed, without basal auricles, bearing two callosities toward the base; wings free, narrow, auricled; keel falcate, produced or rostrate, sometimes spirally coiled at tip, the petals partly united; stamens monadelphous,

the vexillar one more or less free; anthers all alike; style glabrous; stigma capitate; pods stipitate, oblong or linear, beaked, straight or curved, compressed, the inner layer not loose, each valve strengthened by three or four longitudinal ribs, one very close to each suture, the other one or two toward the middle; seeds several to many, ellipsoid and compressed or lentiform, the hilum linear.

Species 12, tropical or subtropical in the Western Hemisphere. The truncate upper calyx lip, the absence of auricles on the standard, the rostrate keel, and the different pod characters seem ample justification for keeping *Wenderothia* distinct from *Canavalia*.

The 12 species of *Wenderothia* occur scattered through Mexico and southward to southern Brazil and Bolivia, only one species being found in the West Indies, *W. altipendula* of Jamaica. Apparently all are strictly tropical plants and nearly all are woody-stemmed perennials. None have any particular economic value, though several might well be employed as ornamental.

The mechanism of the flowers of *W. mattogrossensis* and *W. grandiflora* has been described and figured by Malme (Ark. för Bot. 4¹: 7-11. 1905), and of *W. mattogrossensis* by Lindman (Bih. Svensk. Vet. Akad. Handl. 27: Afd. III. No. 14: 55. 1902). Lindman says the flowers of the latter species are visited by large bumblebees. The insect alights on the standard, inserts its beak into the cleft on the upper side of the keel, and presses downward to reach the nectar. As a result, the tip of the keel is depressed and the stamens and stigma are extruded.

KEY TO THE SECTIONS AND SPECIES.

Pod valves each with four longitudinal ridges, one near each suture, the other two equidistant.....1. *Tetrapleura*.

Pod valves each with three longitudinal ridges, one near each suture, the third near the middle.....2. *Cochlitropis*.

1. *Tetrapleura*. Leaflets membranous; keel produced, rostrate, spirally twisted at apex; pod valves each with four longitudinal ribs, one close to each suture, the other two equidistant from each other and from the sutures.

Stems woody; leaflets glabrous; upper lip of calyx emarginate, not apiculate, very short; corolla yellowish; hilum one-twelfth the circumference of the seed.....1. *W. acuminata*.

Stems herbaceous; leaflets puberulent; upper lip of calyx not emarginate, apiculate, as long as the tube; corolla purple; hilum about one-third the circumference of the seed.....2. *W. bicarinata*.

2. *Cochlitropis*. Mostly shrubby vines with membranous or chartaceous leaflets; calyx with upper lip of calyx entire, usually apiculate, and lower lip 3-lobed; keel produced, rostrate to spiral at tip; pod valves each with three longitudinal ridges, one near each suture, the third nearer to the ventral than to the dorsal suture; seeds compressed.

Ribs of pod winglike. Leaflets obtuse and emarginate.....3. *W. obidensis*.
Ribs of pod not winglike.

Apex of leaflets obtuse to acutish.

Calyx silvery-sericeous; bractlets orbicular.....3. *W. palmeri*.

Calyx not silvery-sericeous; bractlets ovate.....5. *W. mattogrossensis*.

Apex of leaflets acuminate but with the very tip blunt and apiculate.

Leaflets chartaceous, glabrous.

Corolla 2 cm. long; keel not spiral at tip.....6. *W. altipendula*.

Corolla 4 cm. long; keel spiral at tip.....7. *W. grandiflora*.

Leaflets membranaceous, rarely glabrous.

Lower calyx lobes rather large, ovate, subequal; raceme very dense.

8. *W. hirsuta*.

Lower calyx lobes small, triangular, the median narrower and longer; raceme not very dense.

Calyx ferruginous-pubescent.³

Leaflets lance-oblong, attenuately acuminate; intermediate rib of pod 3 to 4 mm. from the ventral one-----9. *W. picta*.

Leaflets oblong, abruptly acuminate; intermediate rib of pod 5 mm. from the ventral one-----10. *W. lasiocalyx*.

Calyx not ferruginous-pubescent.

Leaflets small, elliptic, softly puberulent on both sides; branches slender, densely ferruginous-pubescent-----11. *W. lenta*.

Leaflets large, oblong to ovate, usually canescent-strigillose to tomentulose beneath, sometimes glabrous or nearly so; branches usually cinereous-pubescent, sometimes ferruginous-pubescent.

12. *W. villosa*.

1. *Wenderothia acuminata* (Rose) Piper.

Canavalia acuminata Rose, Contr. U. S. Nat. Herb. 1: 322. 1895.

Whole plant glabrous except the petiolules and inflorescence; stems terete, woody; stipules not seen; petioles slender, about equaling the leaflets; leaflets membranaceous, ovate to obovate, rounded at base, conspicuously acuminate, the tip obtuse and apiculate, 5 to 10 cm. long; peduncles much shorter than the 10 to 30-flowered thyrses, the pedicellar glands very prominent; calyx campanulate, minutely strigillose, 14 mm. long, the broad emarginate upper lip very short, not longer than the 3-lobed lower lip, with nearly orbicular lobes about 2 mm. long; standard 3 cm. long, the blade broadly oval, slightly notched at the reflexed tip, bearing two linear callosities in the middle near the base, the claw broad, about 7 mm. long; wings much shorter than the keel, linear, auricled at base, slender-clawed; keel 3 cm. long, falcate, the narrowed beak partly coiled, each petal auriculate at base, the claw slender; style glabrous; stigma clavate; stamens monadelphous, the vexillar one partly free; pods linear, 12 to 15 cm. long, 2 cm. broad, straight, strigillose with white hairs, each valve with 4 prominent ribs, one very close to each suture, the other two equidistant from each other and from the sutures; seeds lenticular, shiny, 10×12×4 mm., olive-gray, sprinkled with black, the hilum 3 to 7 mm. long, one-twelfth to one-sixth the circumference of the seed.

MEXICO: Manzanillo, Colima, *Palmer* 1036, type (U. S., Kew). San Geronimito, Michoacán or Guerrero, *Langlassé* 714 (Kew).

2. *Wenderothia bicarinata* (Standl.) Piper.

Canavalia bicarinata Standl. Contr. U. S. Nat. Herb. 18: 106. 1916.

Climbing herb; stems very slender, terete, densely puberulent, the hairs somewhat reflexed; stipules minute, subulate, hairy, quickly deciduous; petioles about as long as the leaflets; petiolules 3 mm. long, very puberulent; leaflets membranaceous, oval to ovate, rounded at base, mostly doubly acuminate, the acumination again narrowed to a mucronate point, densely hispidulous above, puberulent beneath, 3 to 5 cm. long; peduncles terete, puberulent, 6 to 10 cm. long, about 6-flowered, the gland at base of each pedicel conspicuous; bracteoles broadly ovate; calyx nearly 2 cm. long, sparsely strigillose, the large

³ In *W. villosa* the calyx is rather rarely ferruginous-pubescent. The usually ovate leaflets and the wider space, 6 to 10 mm., between the ventral and intermediate ribs will serve to separate the species from *W. lasiocalyx*.

upper lip truncate and apiculate, the small lower lip with 3 triangular acute lobes, the middle one longest; corolla 3 cm. long, apparently purple, streaked; standard 3 cm. long, oblong-ovate, obtuse or slightly retuse, clawed at base and with two shallow depressed glands near base, each thickened a little at the upper margin; wings linear, obtuse, twisted, 2 cm. long, much shorter than the keel; keel strongly falcate, long-rostrate, twisted in a single spiral near the bilobed apex; style glabrous; stigma terminal, capitate; pods linear, compressed, densely strigillose, 10 to 14 cm. long, 15 to 18 mm. wide, each valve with 4 longitudinal ridges, one close to each suture, one 4 to 6 mm. from the ventral rib and the fourth 4 mm. from the dorsal rib; seeds (scarcely mature) oval, compressed, constricted at the micropylar end, very dark brown, dull, 7 to 8 mm. long, 5 to 6 mm. wide, 2 mm. thick; hilum linear, more than half as long as the seed, about one-fourth its circumference.

PANAMA: Alhajuela, *Pittier* 2354, type (U. S.). Punta Paitilla, near Panama, *Piper* 5169 (U. S.). Penonomé, *Williams* 132 (U. S.).

COSTA RICA: Nicoya, *Pittier* (U. S.).

GUATEMALA: Chupadero, Depart. Santa Rosa, *Heyde & Lux* 3730, distributed as *Phaseolus dysophyllus* Benth. (U. S.).

A peculiar species in its very slender stems and small leaflets.

3. *Wenderothia obidensis* (Ducke) Piper.

Canavalia obidensis Ducke, Arch. Jard. Bot. Rio de Janeiro 3: 173. 1922.

The original description by Ducke is as follows:

"Herba volubilis minime tomentella, foliis ut in *C. gladiatâ* at minoribus et angustioribus (usque ad 7 cm. longis ad $2\frac{1}{2}$ c. latis). Flores quam in specie citatâ minores, dilute roseo-violacei, calice angustiore, labii superioris lobis minoribus. Vexillum laminâ circa 13 mm. longâ 10 mm. latâ basi bicallosâ at non appendiculatâ unguiculo circa 6 mm. longo; alae angustissimae; carina in rostrum breve incurvum terminata. Ovarium pilosum, basi attenuatum. Legumen junius parce pilosulum, maturum glabrum, 11 ad 12 cm. longum 2 ad $2\frac{1}{2}$ cm. latum, alis in utroque latere suturarum circa 3 cm. a suturâ distantibus alâque longitudinali (in valvis medianâ) munitum. Semina 1 cm. vix longiora valde compressa $\frac{2}{3}$ vel $\frac{3}{4}$ cm. lata, nigra, nitidula, dura.

"Species calicis formâ ad sect. II accedit ubi *C. gladiatae* characteribus multis approximatur, at vexilli formâ ad sect. I spectat ubi petalorum structurâ *C. pictae* Benth. affinis videtur.

"Obidos, in terris argillosis ab Amazonum fluvio periodice inundatis inter vegetationem secundariam, A Ducke 12-8-1916 n. 16336.

"Cette espèce a le calice du bien connu *C. gladiata*, mais le labre supérieur moins profondément bilobé; l'absence des appendicules de l'étendard, et l'aile médiane des valves de la gousse ne permettent pas de la confondre avec ce dernier."

The specimen in the National Herbarium has no flowers but does have nearly ripe pods. From this the following data are added:

Apparently a woody climber; stems slender, terete, pale, glabrous; petioles slender, glabrous, shorter than the leaflets; petiolules sparsely puberulent; leaflets rather thin, somewhat coriaceous, elliptic to lanceolate, truncate at base, obtuse and notched at apex, paler beneath, glabrous except a sparse puberulence on the principal veins above, 4 to 8 cm. long, 2 to 3 cm. broad; glands at the base of the pedicels not prominent; pods woody, linear, sharp-pointed at tip, 10 cm. long, 2 cm. broad, dark-colored, sparsely strigillose, each valve with 3 winglike longitudinal ridges, one 4 mm. high close to the ventral suture, one 3 mm. high near the dorsal suture, and the third 2 mm. high about one-third the width of the pod from the ventral suture; seeds (immature) dark, shiny, much compressed, 12 mm. long, the dark linear hilum 10 mm. long, more than one-third the circumference of the seed.

4. *Wenderothia palmeri* Piper, sp. nov.

Stems slender, terete, densely soft-canescenscent or near the tips fulvous-pubescent; petioles densely pubescent, about as long as the leaflets; stipules and stipels not seen; leaflets membranaceous, oval to ovate, obtuse to acute, weakly apiculate, green and strigillose above, densely soft-canescenscent beneath, 3 to 6 cm. long; peduncles stout; thyrses about 6-flowered; pedicels 2 to 4 mm. long, the gland at base of each prominent, semiglobose; calyx bracts suborbicular, canescenscent; calyx 1.5 to 2 cm. long, densely canescenscent or slightly rusty-pubescent, the orbicular emarginate upper lip equaling or exceeding the tube, the small lower lip with three broadly ovate, acutish, subequal teeth 5 mm. long; corolla purple, 3 cm. long; standard 3 cm. long, elliptic, slightly emarginate, reflexed, attenuate at base into a short broad claw, bearing at the base of the blade a linear callosity on each side of the median groove; wings shorter than the keel, linear, twisted, the basal auricles rounded, the slender claw 6 mm. long; keel 3 cm. long, falcate, petals united above the middle to the tip into a narrow twisted beak, each auricled at base and with a slender claw 6 mm. long; style glabrous; stigma capitate; pod (immature) linear, 10 cm. long 2 cm. broad, densely soft-canescenscent, one rather prominent longitudinal ridge close to the ventral suture, a less prominent one very close to the dorsal suture, and a median one nearer to the ventral than to the dorsal suture; immature seeds with the hilum nearly as long as the seed.

Type in the U. S. National Herbarium, no. 266512, collected at Acapulco, Mexico, 1894-95, by Edward Palmer (no. 575). This same collection in the Kew, Gray, and New York herbaria bears the number 375.

MEXICO: Sierra Madre, Michoacán or Guerrero, *Langlassé*, February, 1899 (U. S., Kew, N. Y., Gray). Tonalá, Chiapas, *Nelson* 2881 (U. S.).

Closely allied to *W. villosa* and *W. hirsuta*, but differing from both in the fact that the leaflets are not acuminate, and by the intermediate characters of the lower calyx lip.

5. *Wenderothia mattogrossensis* (Rodr.) Piper.

Mucuna mattogrossensis Rodr. Pl. Mattogr. 15. 1898.

Canavalia mattogrossensis Malme, Ark. för Bot. 4⁷: 9. 1905.

Stems herbaceous, slender, terete, white-puberulent; petioles densely pubescent, shorter than the leaflets; stipules "minute, setaceous" (Rodrigues); stipels minute; leaflets membranaceous, oval or slightly ovate, rounded or slightly subcordate at base, obtuse, rarely acutish, never acuminate at apex, apiculate, sparsely white-puberulent above, more densely so beneath, 4 cm. long; peduncles puberulent, 2 to 3 cm. long, shorter than the 10 to 12-flowered thyrses; bracteoles ovate, acutish, 2 mm. long; calyx 18 mm. long, densely canescenscent, the truncate apiculate upper lip shorter than the tube, the lower lip 3 mm. long, the lateral teeth ovate, acute, the median ovate, triangular, acuminate, longer and narrower; corolla "lilac" (Malme,) or "blue violet" (Lindman); standard 3 cm. long, oblong, emarginate, the sides reflexed, attenuate at base to a broad claw 7 mm. long, bearing toward the base two prominent conic callosities; wings as long as the keel, linear-spatulate, loosely coiled, short-unguiculate and bearing at base of blade a small obtuse inflexed auricle; keel 3 cm. long, narrow, falcate, rostrate, inflexed at tip, unguiculate at base, each petal with a small oblong auricle at base, the two petals united toward their tips; stamens monadelphous; anthers oblong-linear; ovary linear, pubescent; style glabrous; stigma capitate; pods not seen but according to Rodrigues's description and figure nearly straight, beaked at tip, stipitate, 11 to 12 cm. long, densely hirsute-villous with chestnut-colored hairs, the valves 3-ribbed, one rib near each suture, the third near the middle.

This species was originally described by Rodrigues who found it at several places in Matto Grosso, namely barrancas of the Rio San Lourenço, banks of the Rio Coxipo, an affluent of the Cuyaba, and in the Engenho San Joao. Malme (Ark. för Bot. 4^r: 9. 1905) reports it as abundant along the Cuyaba River at Santa Anna da Chapada, Matto Grosso, flowering profusely in April. Lindman (Bih. Svensk. Vet. Akad. Handl. 27: Afd. III. No. 14: 54. 1902) describes the mechanism of the flower and its pollination by bumblebees as observed at Santa Cruz da Barra, Matto Grosso, but he erroneously refers the plant to *C. picta* Mart.

BRAZIL: Cuaba (Cuyaba) River, Matto Grosso, *La Plata Exped., Capt. Page* (U. S.).

PARAGUAY: Between Río Apa and Río Aquidabán, *Fiebrig* 5118 (Gray, Mo.). Apo River, *Hassler* 8287 (Kew). Cordillera de Altos, *Hassler* 42, 2542 (Kew). Tobati, *Fiebrig* 790 (Kew). San Bernardino, *Hassler* 12559 (U. S.).

6. *Wenderothia altipendula* Piper, nom. nov.

Canavalia altissima Macfad. Fl. Jam. 1: 292. 1837, excluding synonymy.

Stems terete, woody, glabrous; petioles terete, slender, glabrous, mostly shorter than the leaflets; petiolules puberulent, 5 mm. long; stipules and stipels not seen; leaflets coriaceous, oblong to elliptic, rounded at base, acuminate to a blunt apiculate tip, glabrous, 6 to 15 cm. long; peduncles strigillose or glabrate, 6 to 10 cm. long, mostly longer than the 10 to 15-flowered thyrses, the pedicellar glands large, hemispheric; bracteoles orbicular; calyx 10 to 12 mm. long, minutely strigillose or glabrous, the broad upper lip apiculate and shorter than the tube, the lower lip 2 mm. long, the lateral teeth ovate, the median narrower and longer; corolla purple; standard 2.5 cm. long, ovate, emarginate, reflexed, attenuate at base to a short claw, bearing two linear callosities toward the base, one on each side of the median groove; wing 18 mm. long, oblanceolate, twisted, the basal auricle semicircular, the claw 5 mm. long; keel 20 mm. long, sharply falcate, obtuse-beaked, the petals united at tip, each with a blunt auricle at base, the claws 5 mm. long; stigma with an inflexed appendage; stamens monadelphous; anthers dark; ovary densely strigillose; pods linear-oblong, brown, strigillose, 15 cm. long, 2.5 cm. broad, nearly straight, 3-ribbed, one rib near each suture, the intermediate one 6 to 9 mm. from the ventral suture; seeds shiny, ellipsoid, compressed, brown, speckled with black, a pinkish border around the hilum, 15×10 mm.; hilum toward the micropylar end, about one-eighth the circumference of the seed.

JAMAICA: Without locality, *Macfadyen; Distin* (Kew). Oxford, *Marble* 503 (U. S., N. Y.). St. Margaret's Bay, *Fredholm* 3270 (U. S., N. Y.). Santa Cruz Mountains, *Britton* 1305 (N. Y.). Bluefields, *Britton* 2004 (N. Y.). Mandeville, *Britton* 1012 (N. Y.).

Macfadyen records the plant from Port Royal and St. John's Hill. Fawcett and Rendle add Guava Ridge and near Troy. The species seems confined to Jamaica. Macfadyen thought his plant to be the same as *Dolichos altissimus* Jacq. (*Mucuna altissima* DC.), and thus derived his specific name. This misconception on his part should invalidate the specific name he used.

7. *Wenderothia grandiflora* (Benth.) Piper.

Canavalia grandiflora Benth. Ann. Wien. Mus. Naturg. 2: 135. 1838.

Whole plant glabrous to the inflorescence; stems terete, slender, woody; stipules and stipels not seen; petioles shorter than the leaflets; petiolules glabrous, 3 to 4 mm. long; leaflets thin, coriaceous, shiny above, elliptic to oval, rounded or subcordate at base, acuminate (the tip blunt and apiculate), 6 to 10 cm. long; peduncles 5 to 8 cm. long, about equaling the 10 to 20-flowered thyrses, the rachis glabrous or strigillose; bracteoles orbicular; calyx 15 to

17 mm. long, campanulate, minutely strigillose; bracteoles orbicular; calyx 15 to 17 mm. long, campanulate, minutely strigillose, the broad upper lip as long as the tube and recurved-apiculate, the lower lip 3 to 4 mm. long, with ovate teeth, the median slightly longer and thicker; standard 4 cm. long, ovate, emarginate, reflexed, attenuate at base to a short claw, bearing two linear callosities near the base, one on each side of the median groove; wings linear, twisted, 2 to 5 cm. long, short-clawed, the basal auricle semicircular; keel longer than the wings, falcate, the petals united toward the tip, the narrowed beak curved into a complete spiral, the basal auricle small, blunt; style glabrous, the stigma terminal, with an inflexed appendage; pods not seen.

BRAZIL: Pilar, Parahyba, *Pohl*, type (Kew). Near Goyaz, *Burchell* 7079 (Kew). Santarem, Pará, *Ducke* 17088 (U. S.). Alcobaza, *Ducke* 16194 (U. S.).

Reported also by Benthams from Salinas, *Weddell*. Malme (Ark. för Bot. 4¹: 7. 1905) reports the plant from Santa Anna da Chapada, Matto Grosso, stating that the flowers appear in May and June and are odorous like sweet peas, and that the standard is whitish with violet spots or bands which coalesce near the margin.

A young pod on the Santarem specimens is finely puberulent and 3-ribbed, evidently very similar to that of *W. villosa*.

8. *Wenderothia hirsuta* Mart. & Gal. Bull. Acad. Sci. Brux. 10²: 192. 1843.

Canavalia hirsuta Standl. Contr. U. S. Nat. Herb. 23: 495. 1922.

Stems terete, woody, densely pubescent, the hairs usually fulvous; petioles rusty-pubescent, mostly shorter than the leaflets; stipules and stipels not seen; petiolules very pubescent, 3 to 4 mm. long; leaflets membranaceous, ovate, rounded or subcordate at base, long-acuminate (the tip acute), sparsely puberulent above, densely so beneath, reticulate-veined, 8 to 12 cm. long; peduncles 10 to 15 cm. long, densely pubescent, much longer than the very dense, 15 to 25-flowered thyrses; pedicellar glands large, subglobose; bracteoles orbicular; calyx densely appressed-pubescent with fulvous hairs, 15 to 18 mm. long, the upper lip entire, apiculate, the lower lip 7 mm. long, with 3 subequal, broadly ovate, obtuse lobes; corolla rose-purple; standard oblong, emarginate, reflexed, 3 cm. long, bearing on each side of the median groove toward the base a narrow linear callosity, the slender claw 8 mm. long; wings shorter than the keel, linear, twisted, each with a rounded auricle at base and a slender claw 7 mm. long; keel 3 cm. long, falcate, rostrate and usually spiral at tip, the petals united above, the basal auricles rounded; style glabrous; stigma capitate; pod not seen.

The original specimens (not seen) were from Rincón, Talea, Oaxaca, Mexico, *Galeotti* 3424. The following specimens agree perfectly with the description:

MEXICO: Orizaba, *Botteri* 1152 (U. S., Kew, Gray); *Bourgeau* 2668, 2916 (Kew, Gray).

GUATEMALA: Cobán, *Türkheim* 237 (U. S., Kew, Gray).

9. *Wenderothia picta* (Mart.) Piper.

Canavalia picta Mart.; Benth. Ann. Wien. Mus. Naturg. 2: 135. 1838.

Stems slender, woody, terete, hirsutulous; stipules and stipels not seen; petioles hirsutulous, about as long as the leaflets; petiolules densely hirsutulous, 3 mm. long; leaflets thin, coriaceous, oblong to narrowly ovate, rounded to subcordate at base, long-acuminate, with blunt apiculate tip, sparsely reddish-puberulent when young, especially on the veins, becoming glabrous, 8 to 12 cm. long; peduncles terete, hirsutulous, mostly longer than the thyrses, 6 to 15 cm. long; pedicellar glands roundish, prominent; thyrses 10 to 20-flowered; bracteoles orbicular, caducous; calyx campanulate, minutely strigillose, 18 mm. long, the upper lip abruptly apiculate, as long as the tube, the lower lip 3 mm.

long, the lateral teeth broader, thinner, and shorter than the median tooth; standard "lilac," striate-nerved, broadly oval, not retuse, attenuate into the short claw, reflexed from near the base, 2.5 cm. long, bearing a conic callosity on each side of the median groove where the petal is reflexed; wings "rose", oblong, each bearing a semicircular auricle at base, 18 mm. long including the short claw (4 mm. long); keel "rose-lilac", broadly falcate, the two petals united above, the beak narrowed but blunt, sometimes twisted at tip, auricled at base, short-clawed, 3 cm. long, equaling the standard; stamens and style not examined; pods short-pediceled, linear, compressed, short-beaked, covered with short reddish hairs, one rib close to each suture, the third 3 mm. from the ventral rib, 10 to 12 cm. long; seeds "oblong, compressed, the linear hilum shorter than the seed."

BRAZIL: Organ Mountains, Province of Rio de Janeiro, *Gardner* 355 (Kew). Near Caldas, Minas Geraes, *Regnell* 82, 83 (Kew). Sumidouro, *Langsdorff* 178 (Kew). Without locality, *Sello* (Kew).

Bentham cites also the following: Near Cabo d'Agosta in Serro Frio, Minas Geraes, *Martius* (type); Minas Geraes, *St. Hilaire*.

I have seen no pods with well-developed seeds, but these are described by Bentham. There were available no flowers good enough to permit examination of the pistil and stamens, and these organs are not described by Bentham. According to St. Hilaire (ex Bentham) the flowers have the odor of sweet peas.

10. *Wenderothia lasiocalyx* (Kuntze) Piper.

Canavalia lasiocalyx Kuntze, Rev. Gen. Pl. 3²: 55. 1898.

Twining shrub; stems slender, terete, pubescent with spreading fulvous hairs; petioles fulvous-pubescent, shorter than the leaflets; stipules not seen; stipels subulate, minute; leaflets firm-membranaceous, elliptic, rounded at base, acutely short-acuminate at apex, green and sparsely puberulent above, paler and sparsely pubescent beneath, especially on the nerves, 5 to 8 cm. long, the ribs prominent beneath; petiolules 5 mm. long, densely puberulent; peduncles densely fulvous-puberulent, mostly shorter than the inflorescence; thyrses dense when young, 15 to 20-flowered; pedicels very short, their basal glands large; bracteoles ovate, acute, densely pubescent; calyx 1 cm. long, streaked with dark purple lines, densely fulvous-pubescent with appressed hairs, the broad upper lip truncate and shorter than the tube, the lower lip small, with three lance-ovate acuminate lobes; corolla purple, 3 cm. long; standard oblong-ovate, emarginate, the claw broad, 6 mm. long, the callosities conic, prominent; wings linear-spatulate, obtuse, without median auricles; keel narrow, curved, rostrate, 3 cm. long, slightly incurved at tip; pods linear, 12 mm. broad, 8 to 10 cm. long, compressed, densely villous with spreading fulvous hairs, one rather prominent longitudinal ridge close to the ventral suture, a second less prominent one very close to the dorsal suture, and a third median one 4 to 5 mm. distant from the ventral suture and nearly twice as far from the dorsal; seeds ellipsoid, much compressed 7×5×5 mm., pale brown, splotted with dark brown, shiny, the linear hilum nearly as long as the seed, about one-third its circumference, covered with a thick white caruncle.

Type collected by Kuntze at Santa Cruz de Sierra, Bolivia, altitude 1,000 meters.

BOLIVIA: Yapacani, June, 1892, in fruit, *Kuntze* (U. S., N. Y.). Yungas, *Bang* 586, in flower (Gray, N. Y., U. S.); *Rusby* 1325 (U. S.). Mapiri, *Rusby* 2856 (N. Y.). Machichoirisa River, *Williams* 1584 (N. Y., U. S.), with mature fruit.

PERU: Santa Ana, alt. 900 m., *Cook & Gilbert* 1611 (U. S.).

Kuntze distributed the Yapacani plant as *C. picta* Mart., and it is possible that his Santa Cruz plant, the basis of *C. lasiocalyx*, is different.

11. *Wenderothia lenta* (Benth.) Piper.

Canavalia lenta Benth. Ann. Wien. Mus. Naturg. 2: 135. 1838.

Stems slender, terete, densely puberulent, apparently herbaceous; stipules and stipels not seen; petioles densely puberulent, shorter than the leaflets; petiolules 2 mm. long, densely puberulent; leaflets elliptic to slightly ovate, rounded at base, acuminate, the tip acute and apiculate, densely soft-puberulent on both sides, 4 to 7 cm. long; peduncles as long as the racemes; pedicellar glands roundish, conspicuous; thyrses about 10-flowered; calyx campanulate, 15 mm. long, the upper lip stoutly apiculate at tip, as long as the tube; lower lip 3 mm. long, the teeth triangular, subequal, the median thicker; standard broadly oval, not retuse, reflexed, attenuate at base to a very short claw, bearing two papillate callosities near the base; wings 20 mm. long, oblong, twisted near the base, the auricles semicircular, the short claw 2 mm. long; keel 25 mm. long, broadly falcate, the narrowed tip incurved or twisted, the basal auricles small, the short claw 2 mm. long; style glabrous; stigma capitate.

BRAZIL: Cabellado, *Pohl*, type (Kew).

Reported also from Paraguay, *Balansa* 3096 (Bull. Herb. Boiss. II. 4: 902. 1904).

12. *Wenderothia villosa* (Benth.) Piper.

Canavalia villosa Benth. Ann. Wien. Mus. Naturg. 2: 135. 1837. The type of this, in the Munich herbarium, is a flowering specimen collected somewhere in Mexico by Karwinsky. The branchlets and petioles are densely ferruginous-hirsutulous, the leaflets sparsely puberulent above and densely canescent-tomentulose beneath, elliptic to elliptic-ovate, with the short acumination blunt and apiculate at tip; calyx densely ferruginous-tomentulose, scarcely "villose"; lower calyx lip not entire but with 3 lobes, these all triangular and acutish, the median 2 mm. long, longer and thicker than the lateral ones; keel slightly twisted at tip. In the pubescence of the calyx this specimen is quite unusual. The best match for it examined is from Ocuila (? Ocuilán), State of Mexico, *F. Salazar*, November 16, 1911, which specimen has even longer, denser, and darker pubescence on the calyx.

Canavalia rostrata Benth. Ann. Wien. Mus. Naturg. 2: 135. 1837. The type of this, in the herbarium at Munich, is a fragmentary specimen in bloom, collected somewhere in Mexico by Karwinsky. It is evidently a shade specimen. Stems slender, sparsely strigillose; leaflets thin, elliptic to ovate, with a rather long acumination, but the very tip blunt and apiculate, glabrous above except on the nerves, sparsely strigillose beneath; calyx nearly glabrous, the lower lip 3-lobed, 3 mm. long; corolla (straightened out) 3 cm. long.

Wenderothia discolor Schlecht. Linnaea 12: 331. 1838. The original specimens from Jalapa, Veracruz, *Schiede*, for which the genus *Wenderothia* was proposed, have not been examined. The long description accords closely with *Rose & Hay* 6129 from the same place. In the latter the calyx is nearly glabrous and, as described for *W. discolor*, the under leaf surface is densely tomentulose.

Neurocarpum multiflorum Hook. & Arn. Bot. Beechey Voy. 286. 1841.

Canavalia multiflora Hook. & Arn. Bot. Beechey Voy. 416. 1841. The type, in the herbarium at Kew, is said to have been collected by Sinclair somewhere on the west coast between San Blas, Mexico, and Realejo, Nicaragua. The specimen is in young fruit. Leaflets sparsely strigillose beneath; calyx sparsely strigillose; stems hirsutulous, the hairs somewhat reflexed.

Wenderothia glabra Mart. & Gal. Bull. Acad. Sci. Brux. 10³: 191. 1843. The original specimens, not seen, are from Hacienda de Mirador, Veracruz. The only points in the description that seem diagnostic are the white flowers and the minutely fulvous-pilose stems. Specimens from the type locality, *Nelson* 90, *Linden* 723, and *Sartorius* 2800, have the fulvous-pilose stems, but the corollas in the Sartorius and Linden specimens are certainly purple.

Wenderothia pilosa Mart. & Gal. Bull. Acad. Sci. Brux. 10³: 191. 1841. The type collection is Galeotti's 3273 from Zacuapan, Veracruz, and duplicates are in the herbarium at Kew. The only unusual feature of the specimens is the spreading fulvous pubescence of the stems, perhaps best described as thinly short-pilose. The pubescence of the under leaf surface and of the calyx is similar but less erect.

Stems perennial, woody, terete, climbing, more or less densely pubescent, hirsutulous to strigillose, rarely quite glabrous; petioles about as long as the leaflets, varying in pubescence like the stem; petiolules 4 to 6 mm. long, usually densely puberulent; stipules lanceolate, attenuate, 3 mm. long; leaflets 4 to 10 cm. long, thin to rather thickish, membranaceous, oval to ovate or somewhat obovate, sometimes merely acute, usually with a more or less elongate acuminate apex, the tip blunt and apiculate, rounded to subcordate at base, sometimes glabrous or nearly so on both sides, usually sparsely strigillose above, strigillose to densely tomentulose beneath, the pubescence usually whitish but varying to ferruginous; peduncle stout, usually longer than the young inflorescence, this 10 to 25-flowered; pedicellar glands very prominent; thyrses 10 to 30-flowered; bracteoles ovate-orbicular, 2 to 3 mm. long; calyx campanulate, 12 to 15 mm. long, glabrous to strigillose or tomentulose, canescent to ferruginous, the truncate apiculate upper lip nearly as long as the tube, the lower lip 3-lobed, 2 to 3 mm. long, the lateral lobes ovate-triangular, thinner and shorter than the median lobe; corolla reddish purple (white in *W. glabra*, according to Galeotti); standard 3 to 3.5 cm. long, elliptic to oblong-ovate, emarginate, reflexed below the middle in anthesis, not auricled at base, bearing two elongate callosities below the middle, the claw 1 cm. long; wings linear-oblong, obtuse, at length twisted, shorter than the keel, a rounded inflexed auricle at base of blade of each; keel 3 cm. long, long-rostrate, falcate, the two petals united from above the middle to the tip, each with a small basal auricle, the tip often coiled into a single spiral; style glabrous; stamens monadelphous; pods nearly straight, beaked, compressed, 10 to 20 cm. long, 1 to 1.5 cm. wide, densely tomentulose with white to ferruginous hairs, the valves 3-ribbed, one rib near each suture, the median one about twice as far from the dorsal suture as from the ventral; inner layer of pod closely adherent; seeds oval in outline, compressed, chestnut-colored, sprinkled with unequal brown dots, 10×7×4 mm., the dark hilum surrounded by a nearly black border, and extending one-eighth to one-fourth the circumference of the seed.

Study of the extensive series of specimens listed seems to indicate that all the names cited pertain to but a single species ranging throughout Mexico and south into Panama. The forms vary mainly in the amount of pubescence on the calyx and leaves. This pubescence is usually short-appressed on the calyx and leaves and commonly white, but not rarely tomentulose or short-pilose and frequently ferruginous. In all the specimens cited the leaflets are similar in form and alike in being acuminate, the tip blunt and apiculate. They vary however in texture as well as amount of pubescence, these doubtless being fluctuating variations due to environmental influences. Benthham in publishing *C. villosa* described the lower lip as entire, but a reexamination of the type shows it to be 3-lobed. The lateral teeth are often small or obscure,

which perhaps led Bentham to describe the calyx lip of *C. rostrata* as "subentire," but in the type of this it is clearly 3-lobed.

Bentham also contrasted *C. villosa* and *C. rostrata*, stating that the keel was slightly twisted in the former but not so in the latter. I have been unable to escape the conclusion, from many examinations, that this difference is due to the age of the flowers, and is not specific. In a young flower the keel is usually not twisted.

So far as pubescence is concerned, every gradation can be found from glabrous or nearly glabrous to densely short-pubescent or to tomentulose, both on the calyx and on the lower leaf surfaces. Indeed, a series of specimens may be selected all with the leaflets densely pubescent beneath, but in this series the calyx will vary from glabrous to densely strigillose or to tomentulose. On the other hand, a series of specimens with the calyx glabrous or nearly so will show all variations as regards the pubescence on the leaflets. In short, there is no correlation as regards the pubescence of calyx and leaflets, nor has any been detected with other variable organs.

COAHUILA: Caracol Mountains, *Palmer* 259 (U. S., Kew).

NUEVO LEÓN: Monterrey, *Edwards* (Kew). Nuevo León, *Pringle* 2274 (Gray). Sierra Madre near Monterrey, *Pringle* 2506 (U. S., Kew).

TAMAULIPAS: Gómez Farias, *Palmer* 268 (U. S.). Tampico, *Palmer* 167 (U. S.).

SINALOA: San Ignacio, *Montes & Salazar* 29, 704, 744 (U. S.).

DURANGO: Durango, *Rose* 2320 (U. S.).

ZACATECAS: Colotlán to Bolaños, *Rose* 2839 (U. S.). Monte Escobedo, *Rose* 2632 (U. S.). Bolaños to Guadalajara, *Rose* 3042 (U. S.).

SAN LUIS POTOSÍ: Pelote, *Purpus* 4851 (U. S.). Bagre, *Purpus* 5203 (U. S.).

JALISCO: Guadalajara, *Pringle* 2118 (Gray); *Rose & Painter* 7367 (U. S.); *Berlandier* (Kew); *Rose & Hay* 6401 (U. S.). Etzatlán, *Rose & Painter* 7523 (U. S.). Río Blanco, *Palmer* 162 (U. S.). Chapala, *Rose & Hay* 7659 (U. S.).

GUANAJUATO: Guanajuato, *Dugès*, August, 1895 (Gray).

HIDALGO: Zimapán, *Beechey* (Kew); *Coulter* (Kew).

VERACRUZ: Valley of Córdoba, *Bourgeau* 1857 (Gray), 1895 (U. S.), 1855, 1537 (Kew). Orizaba, *Bourgeau* 2802 (Kew), 2916 (Gray); *Botteri* 970, 374 (Gray), 118, 1152 (U. S.), 728, 1153 (Kew). Veracruz to Orizaba, *Müller* 1311 (Kew). Jalapa, *Rose & Hay* 6129 (U. S.). Hacienda Mirador, *Nelson* 90 (U. S.). Río Blanco, near Orizaba, *Bourgeau* 2675 (Kew). Veracruz, *Galeotti* 3273 (Kew), type of *Wenderothia pilosa*. Mirador, *Linden* 723 (Kew). Huatusco, *Liebmann* 5254 (U. S.). Wartenburg, *Ervendberg* in 1858 (U. S.).

MICHOACÁN: Morelia, *Arsène* 2760 (Gray); *Galeotti* 3367 (Kew). Mt. Santa Helena, *Langlassé* 65 (U. S.). Sierra Madre, *Langlassé*, February, 1899 (U. S.).

GUERRERO: Acapulco, *Palmer* 575 (U. S.).

MEXICO: Tlalpam, *Rose & Hough* 4531 (U. S.). Ocuilán, *Salazar*, November 16, 1911 (U. S.).

PUEBLA: Tehuacán, *Rose & Hay* 5904, 9944 (U. S.).

MORELOS: Cuautla, *Holway* 11 (U. S.). Cuernavaca, *Rose & Hay* 6856 (U. S.); *Bourgeau* 1377 (Kew); *Rose & Painter* 6903 (U. S.).

OAXACA: San Felipe del Agua, *Conzatti* 590 (U. S.). Oaxaca, *Nelson* 1224 (U. S.); *Conzatti* 1677 (U. S.); *Conzatti & González* 43 (U. S.); *Purpus* 2679 (U. S.). Monte Albán, near Oaxaca, *Rose & Hough* 4575 (U. S.).

CHIAPAS: Tonalá, *Nelson* 238 (U. S.). San Cristóbal to Teopisca, *Nelson* 3471 (U. S.). Tumbala, *Nelson* 3349 (U. S.). El Carmen, *Doyle* 243 (U. S.). Solosuchiapa, *Doyle* 246 (U. S.).

TABASCO: Teapa, *Linden* (Kew).

MEXICO (state uncertain): Without locality, *Bourgeau* 7377 (Gray); *Beechey* (Kew), type of *Neurocarpum multiflorum*. Villa Thuret, Cap d'Antibes, *Poirault* (Kew). Without locality, *Karwinsky* (Munich), type of *Canavalia villosa*; *Karwinsky* (Munich), type of *Canavalia rostrata*.

GUATEMALA: Huehuetenango, *Nelson* 3575 (U. S.). Neutón, *Nelson* 3537 (U. S.). Without locality, *Heyde* 289 (U. S.). Cubilquitz, *Türckheim* 7849 (U. S., Kew). Morán, *Kellerman* 4839 (U. S.). Chiapas, *Heyde & Lux* 3741 (U. S., Kew). Guatemala, *J. D. Smith* 2296 (Gray); July, 1860, *Hayes* (Gray). Las Vacas Barranca, July, 1860, *Hayes* (Gray). Chiantla, July, 1860, *Hayes* (Gray). Volcán de Fuego, *Salvin* (Kew). Santa María, Quezaltenango, *Kellerman* 5582 (U. S.)

SALVADOR: Volcán de San Salvador, January 9, 1898, *Niederlein* (U. S.)

COSTA RICA: Cartago, *Oersted* 12, 13 (Kew). San Francisco de Guadalupe, *Tonduz* 1564, 1570 (U. S.). San José, *Tonduz* 7222 (U. S.). Desamparados, *Tonduz* 1691 (pods fulvous) (U. S.). Without locality, *Oersted* (U. S.).

NICARAGUA: Chontales, *Tate* (Kew); leaflets lance-elliptic or slightly ovate, thin, glabrous; calyx nearly glabrous.

PANAMA: Sabana de Cerro Vaca, *Pittier* 5298 (U. S.).

ADDITIONAL SPECIES

CANAVALLIA ALBIFLORA Ducke, Arch. Jard. Bot. Rio Janeiro 3: 173. 1922.

Evidently a species of *Wenderothia*, but no specimens have been seen. Ducke's original description is as follows:

"Speciei meridionali *C. picta* omnino similis, differt partibus omnibus paulo minoribus, calice viridi unicolore, petalis albis solum vexillo maculâ parvâ violaceâ notato, et imprimis legumine novello breviter et parum dense griseo-vel subargenteo-piloso demum plus minusve glabrato.

"Habitat in terris argillosis fertilibus inter vegetationem secundariam: civitate Pará prope Santerém (loco Manicá) n. 17.088 prope Montealegre loco Airy n. 16.518 et ad vicinum flumen Maicuru inferius n. 9.530, prope lacum Salgado fluminis Trombetas n. 11.069, prope Alcobaca fluvii Tocantins n. 16.194; civitate Maranhão prope Codó, Her. Gen. Mus. Pará numero 660. Specimina omnia ab A. Ducke lecta, excepto n. 9.530 ab E. Snethlage lecto."

CANAVALLIA CUSPIDIGERA Hoehne, Comm. Linhas Tel. Estrat. Matto Grosso ao Amazonas. Ann. 5. Bot. Part 8: 94. pl. 156. 1919.

"Planta volubilis alte scandens, ramulis novellis, petiolis, pedunculisque minutissime sparseque puberulis vel parce pubescentibus, caulibus adultis glabris; foliis trifoliolatis, petiolo communi fere 3,5–5 cm. longo; foliolis oblongo-ellipticis, fere 5–6 cm. longis et usque 2,5–3 cm. latis, basi rotundatis, 2 mm. longo petiolulatis, apice abrupte 5 mm. longo cuspidato-rostratis et minutissime mucronatis, supra subtusque nervis primariis minutissime sparseque pubescentibus, lateralibus saepius paullo asymetricis; inflorescentiis racemosis, simplicibus, supra medium florigeris et descendentes; floribus violaceis cum vexillo et calyce extus purpureo-striatis vel maculatis saepius geminis in utroque nodulo; calyce tetralobato, extus sparse pubescente et purpureo maculato vel striato, fere 2 cm. longo, lobo vexillari magno, usque 13 mm. longo et 20 mm. lato, apice recurvo, late emarginato et minute mucronato, ceteris parvis, triangularibus, acutis; vexillo infero, late obovato, inferne abrupte angustato et unguiculato, supra unguem calloso incrassato et deinde arcte reflexo, apice late emarginato, marginibus recurvatis, fere 3,2 cm. longo et 2,5 cm. lato, basi necque auriculis necque appendicibus munito; alis unguiculatis, supra unguem abrupte lateque auriculatis dein subcontractis, incurvis, paullulum falcatis, apice rotundatis, fere 3–3,5 cm. longis; carina unguiculata, supra unguem minute obtusoque auriculata, deinde paullo contracta, falciforme curvata et in tertia summa parte conrescentia, alis aequilonga vel paullo longiora; staminibus 10, monodelphis, tubo curvo; ovario pubescente; stylo glabro, incurvo et apicem versus levissime incrassato.

"N.: 2569. Tabula nostra n. 156.

"Leg. ad margines silvarum ad ripas fluminis prope Coxim; floret Maio.

"Planta voluvel, com folhas trifolioladas, foliolos elliptico-alongados, na base arredondados e no apice providos de um prolongamento linear em fôrma de rostro, que é mucronulado, glabros ou levemente pubescentes nas nervuras principaes; inflorescencias racimosas, como as da *Canavalia picta*, Mart., sempre pedentes; flores geralmente 2 em cada nó do racimo, abrindo-se gradativamente, da base para o apice deste, por dentro roxo-violaceas e por fóra, sobre o vexillo e calyce, estriadas ou maculadas de roxo-avermelhado.

"A fôrma do vexillo e demais partes da corolla nao se afastam muito das da *Canavalia picta*, Mart., a fôrma dos foliolos e o revestimento em geral da planta afastam-na porém de todas as descriptas até esta data.

"Como em geral todas as *Canavalias*, é esta uma planta que se recommenda especialmente para cobrir caramanchoes e sébes."

This plant is clearly a *Wenderothia*, allied to *W. picta* but probably distinct.

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